ID 9518
3/01/91
BB

**FMC Corporation**

Phosphorus Chemicals Division

---

**RCRA Part B Permit Application**

---

March 1, 1991

# Pocatello

Submitted to EPA Region X

Copy 2

# Volume 2

Section D

## LIST OF FIGURES

## LIST OF FIGURES (CONT.)

## LIST OF TABLES

## LIST OF TABLES (CONT.)

## LIST OF DRAWINGS

## LIST OF DRAWINGS (CONT.)

| | Title |
|---|---|
| D8.2.1 | Calciner Flue Gas Scrubbing System General Arrangement Water Treatment Area |
| D8.2.2 | Piping Plan, Water Treatment Building |
| D8.2.3 | Arrangement and Details, Reactor Tank Spillway and Containment Area Modifications |
| J1.1.1 | Sprayer Aerator IWW Pond Plan, Sections and Details, Plant Water Balance |
| J1.3.1 | Grading Plan Calciner Interim Slurry Pond 1C |
| J1.3.2 | Sections, Calciner Interim Slurry Pond 1C |
| J1.3.3 | Grading Plan, Calciner Slurry Surge Pond, Pond 2C |
| J1.3.4 | Sections, Calciner Slurry Surge Pond, Pond 2C |
| J1.3.5 | Grading Plan, Calciner Slurry Ponds 3C and 4C |
| J1.3.6 | Sections and Details, Calciner Slurry Ponds 3C and 4C |
| J1.4.1 | Plot Plan - Vicinity Additional Landfill Cells Sanitary and Hazardous Landfill |
| J1.4.2 | Plot Plan and Details and Sections, Additional Landfill Cells New Landfill Cells Area |
| J1.4.3 | Plot Plan and Sections, Additional Landfill Cells Grading Plan, Cross Sections and Centerline Profile |
| J1.4.4 | Details, Additional Landfill Cells Sanitary and Hazardous Facility, Sections and Details |
| J1.4.5 | Plot Plan and Details, Additional Landfill Cells, Existing Sanitary Landfill Closure Detail |
| J1.10.1 | Plan, Location of Settling Ponds, Kiln Dept. |
| J1.13.1 | Plot Plan, Slurry Holding Pond T-57 (10S) |
| J1.13.2 | Plan and Detail, Slurry Holding Pond T-57 (10S) |
| J1.13.3 | Sections and Details, Slurry Holding Pond T-57 (10S) |

## Section D

## PROCESS INFORMATION

Twelve hazardous waste management units (WMUs) are included in this permit application: two storage areas for containers; one waste pile; seven treatment, storage, and disposal surface impoundments; and two miscellaneous treatment units.

*Note*: FMC is considering treating and disposing of hazardous waste (phossy waste) from five FMC burning plants at the Pocatello facility. If and when this decision is made, this section will be amended to include a description of how these wastes will be managed in the existing waste management units and/or additional management units.

### D.1 CONTAINERS [270.15, 264.170 through 178]

The FMC facility has two regulated hazardous waste storage areas for containers. Waste degreasing, paint, and laboratory solvents are stored in the drum storage area prior to shipment for off-site disposal. Andersen filter media is stored in bins in a separate storage area prior to shipment for off-site disposal.

#### D.1.1 Drum Storage Area - WMU #1

WMU #1 is a drum storage area where up to 26 drums of spent solvents are stored prior to shipment off-site for disposal. The waste solvents are of three types: a) laboratory solvents, which may be a mixture of toluene, xylene, and benzene, containing some elemental phosphorus; b) paint solvents, which may be a mixture of xylene, toluene, and methyl ethyl ketone; and c) degreasing solvents, which may be a mixture of methylene chloride, 1,1,1-trichloroethane, and contaminated with dirt, oil, and water.

Management Practices - Spent Laboratory Solvents

The spent laboratory solvents are placed in 5-gallon safety cans in the FMC laboratory in the technical services building by the lab technician. When a can reaches its capacity, the technician carries it to the hazardous waste satellite station located on the west outside wall of the mining laboratory. The lab technician inspects the appropriate drum in the satellite station for damage and makes sure it is properly labeled with a hazardous waste label. The technician then deposits the contents of the can into the drum which is labeled appropriately. The bung on the drum is replaced and tightened after

each transfer. No material is placed in the drums during the heat of the summer day.

A drum is considered to be full when the solvent level is 2 to 4 inches from the top of the drum. The technician ensures that the drum bungs are tightened when the drum is full.

The drum is transported by jib truck to the hazardous waste storage area within three days after it is determined to be full. A lab technician assists the jib truck crew in loading and transferring the drum. At a minimum, two persons are involved in transferring the drum to protect the drum from rupture. When the drum reaches the hazardous waste storage area, the technician writes the accumulation start date on the hazardous waste label. The drums are not stacked, and adequate aisle space is maintained between rows to allow for movement of, and between, the drums.

The jib truck then transports an empty drum back to the satellite station. When the drum is in the hazardous waste satellite station, a technician obtains the required hazardous waste label and flammable liquid label for the drum. An environmental engineer ensures that the hazardous waste label is complete with the proper DOT and RCRA information. The technician places the new labels on the empty drum.

Prior to shipment to the hazardous waste disposal facility, the drums are placed in 85-gallon overpack drums to prevent rupture. These drums are also labeled.

Management Practices - Waste Degreasers and Paint Solvents

Waste degreasing solvents are collected at four satellite stations near the maintenance/machine shop areas and one station at the mining laboratory. Waste paint solvents are collected in a drum located at one satellite station near the paint shop. All satellite stations are located in areas that protect the drums from rupture.

The waste degreasers are collected in 55-gallon polypropylene translucent drums at the maintenance/machine shop locations and a DOT 17E steel drum outside the mining laboratory. All of the degreaser drums are labeled "Waste Degreaser Only." The waste paint solvents are collected in another DOT 17E steel drum. Once wastes have been deposited in the drums, the bung is replaced or the open/close valve is closed. Plant personnel are responsible for ensuring that the integrity of the drums is maintained.

An environmental technician is responsible for monitoring the paint solvent and degreaser drums at the mining laboratory, and for transferring the drums to the hazardous waste storage area within three days of their becoming full. The technician also ensures that all bungs are tightened prior to transfer and

that the accumulation start date is written on the hazardous waste label on the drum when it arrives at the storage area. A jib truck is used to transfer the full drum and replace it with an empty one.

Because the waste degreaser drums at the four maintenance shop locations are polypropylene, a different transfer procedure is used. When a drum becomes full, an environmental technician obtains a new 17E closed-top steel drum and arranges for the contents of the full polypropylene drum to be pumped into the steel drum. The technician then labels the drum with the appropriate hazardous waste label, tightens the bungs, and has the drum transferred to the hazardous waste storage area according to the procedure above. The empty polypropylene drum remains at the satellite station for re-use. The technician ensures that the hazardous waste label is in good condition or is replaced.

Satellite Station Requirements

- Warning/identification signs must be present and visible.
- Drums, bungs, and funnels must be in good condition.
- Drums must have proper labels.
- Emergency information and escape routes must be near the telephone.
- Fire extinguishers must be present.

Hazardous Waste Storage Area Requirements

- Warning/identification signs must be present and visible.
- Drums must be in good condition.
- Drums must have proper labels.
- Emergency information and escape routes must be near the telephone.
- Fire extinguishers must be present.

As part of the above inspection program, FMC will check that each of the above listed items is in place and that regulatory requirements are met.

Secondary Containment

The drum storage area is an 11 ft x 15 ft impervious concrete slab on grade with a 6-inch curb. This pad is periodically inspected for cracks and gaps and any accumulated liquids. Should any liquids accumulate, they would be pumped out and removed. The containment system will hold the volume of the largest container.

### D.1.2 Andersen Filter Media Storage Area - WMU #2

WMU #2 is the Andersen filter media storage area. This area stores the used filter media from the furnace, phos dock, and pond 8S recovery process Andersen scrubbers. The waste filter media, which is in the form of rolled sheets, is composed of 95 percent glass fiber filters and 5 percent combination phosphoric acid and dirt. The used filter media does not contain free liquid.

#### Management Practices - Furnace Building

In the furnace building, the operator removes the contaminated filter media from the furnace tapping fume Andersen scrubber. The contaminated filter media is placed in a sturdy plastic bag and closed with a twist wire tie. Bags are inspected for holes and are double bagged if holes are present. The bagged media is placed on a crane platform in the area designated as a hazardous waste satellite station.

At the end of each shift, the crane operator collects the bagged media from the two platforms, straps it to the outside of the crane, and transports it to the west end of the furnace building. At the crane station on the west end of the furnace building, the crane operator uses an electric winch to lower the bags to a helper outside the furnace building. A chute is being installed to replace the electric winch.

The two-person team on the ground transfers the bagged media into a Bobcat loader and transports it to the storage area. One person removes the tarp from the roll-off dumpster and places the bagged waste in the container. After the waste is placed in the dumpster, the tarp is replaced and secured.

#### Management Practices - Phos Dock and 8S Process

In the phos dock and pond 8S recovery process areas, the contaminated filter media is also placed in bags upon removal. However, the bagged media is placed in satellite accumulation containers (steel dumpsters) in those areas. When a container is full, the operator contacts the Burden business and requests that a loader or forklift be sent to pick up the bagged media. The media is removed from the accumulation container during the same shift that it is deemed full. The bagged media is transferred from the accumulation container to the hazardous waste storage area by one of two means:

- The bagged media is removed from the container, placed in the bucket of a front-end loader and transported to the Andersen filter media storage area and put in the bin; or
- A forklift picks up the entire container, takes it to the Andersen filter media storage area, unloads the bagged media, and returns the container to the satellite station.

An Environmental Engineer will be informed when one of the two dumpsters on the pad is full. The Environmental Engineer will then make the appropriate arrangement to have the used filter media shipped off-site for disposal. All Andersen filter media is manifested off-site as required in 40 CFR 263.20.

The full dumpsters are shipped in their entirety without further disturbance and are replaced with empty dumpsters.

Secondary Containment

The bagged filter media is contained in steel dumpsters in the storage area. The dumpsters are 20 cubic yard ragtop roll-off containers on rails. The ragtops on the dumpsters prevent precipitation from entering the dumpsters. The temporary storage area currently used is a paved surface marked off by "Hazardous Waste Storage Area" caution tape and located west of the furnace building. The area contains two of the roll-off dumpsters to hold and transport the used Andersen filter media.

A permanent containment pad will be constructed for the dumpsters. The pad will be located in the same approximate area. It will be 150 ft x 150 ft and sloped to a 4 ft x 14 ft sump in the center rear of the pad. The pad will have curbing to prevent run on/run off. Releases and precipitation will be collected in the sump to provide 100 percent containment. Its location is shown in Drawing D1.2.2, and its initial design is shown in Drawing D1.2.1.

## D.2 TANKS [270.16, 264.190 through 264.199]

All tanks currently used for treatment and storage are part of a treatment system. Regulatory requirements for the treatment systems are addressed in Section D.8.

## D.3 PRECIPITATOR DUST STORAGE PILE [270.18, 264.250 through 264.259]

WMU #6 (waste pile 9S) is a stockpile for dried precipitator dust. The precipitator dust is transported from the solar drying unit 9E by haul unit. The pile is contained within an old pond area below grade. When stockpiling is complete, a chemical dust suppressant is applied to the pile to prevent windblown emissions. The dust suppressant is applied every eight months or whenever new dust is added to the pile from the drying pond. There is no additional treatment to the pile.

## D.4 SURFACE IMPOUNDMENTS [270.17, 264.220 through 264.231]

### D.4.1 Phossy Waste Surface Impoundment (15S) - WMU #3

WMU #3, pond 15S (see Drawings D4.1-1 through D4.1-4), is a 9.4-acre surface impoundment. It contains a liquid volume of approximately 140 acre-feet of phossy wastes from the Phase IV ponds (11S, 12S, 13S, and 14S) and pond 8S recovery process. It also contains decant water from precipitator pond 9E and waste water liquor from pond 8S.

The liner system includes a double lining of 30 mil, calendered polyvinyl chloride sheeting, specifically manufactured for use in hydraulic facilities. A leachate collection system is installed between the two liners. (See Appendix D-1 for liner and leachate system specifications.)

To prevent overtopping, the pond freeboard is maintained at 2 feet below the top of the liner. If this level is exceeded, water is decanted to the Phase IV ponds. If the level is too low, water may be accepted from pond 8S. This level is measured daily and recorded in the inspection log by the environmental technician.

The technician also inspects the four leachate collection wells weekly for leakage. Any leaks through the liner are recorded in the inspection log and operating record. Should a leak occur, the liquid is pumped out and returned to pond 15S. The dikes are inspected weekly to determine if they have been damaged mechanically or by weathering. If damage occurs, the dike is repaired with crushed slag.

### D.4.2 Slag Pit Waste Water Collection Sump - WMU #5

WMU #5, the slag pit waste water collection sump (Drawings D4.2-1 through D4.2-3), is an area of approximately 100 square feet in the southeast corner of the slag pit area. The sump is unlined and below grade. It receives moisture from several sources, including:

- Rain and snow run-off
- Pit sprays
- Phossy water from the phos dock
- Furnace building and phos dock overflows
- Furnace building washdown water
- Bottom drops from the furnace precipitator

The sump is equipped with a submersible pump designed to remove solids as well as liquid streams. The pump is equipped with a winch to adjust the

pump level according to the fluid level in the sump. The sump is checked two or three times during each shift to ensure proper operation.

The pump is backflushed periodically by turning it off and then on again. (The on-off switch is located at the top of the stairs south of the sump.) Backflushing allows the liquid to travel back down the pipe, through the screen, and back into the sump area, thereby clearing the screen.

As necessary, the solids are dug from the sump and removed. The liquid is pumped to the Phase IV phossy water ponds.

The sump is inspected daily to ensure that minimal water is entering the system. A project is now underway for a tank to replace the sump for phossy water from the furnace building and the phos dock.

### D.4.3 Phossy Waste Surface Impoundment (8S) - WMU #7

WMU #7, pond 8S (Drawing D4.3-1) is the only remaining unlined pond at the facility. It covers about 3.2 acres and stores approximately 70 acre-feet of phossy wastes from past operations. However, phossy wastes have not been placed in the pond since 1981. The phossy wastes in the pond are being processed in the pond 8S recovery process (WMU #4) to recover phosphorus.

Two feet of freeboard is maintained in the pond. The level, which is inspected visually, is monitored daily by the pond operator. If water is needed, it is obtained from pond 15S.

Appendix D-2 includes the specifications on the dredging equipment used in pond 8S.

### D.4.4 Phossy Water Clarifier Surface Impoundments - WMU #8

WMU #8, the four Phase IV ponds (Drawings D4.4-1 through D4.4-5), receives phossy water from several plant operations and waste water liquor from pond 15S. Some drummed phosphorus wastes are deposited in pond 13S at the present time. Water is clarified in these ponds and recycled back to the plant for reuse in the process. The approximate surface areas and volumes of the ponds are as follows:

| | Area, acres | Volume, acre-feet |
|---|---|---|
| Pond 11S | 1.95 | 19.3 |
| Pond 12S | 2.14 | 21.8 |
| Pond 13S | 2.01 | 20.4 |
| Pond 14S | 2.76 | 33.0 |

The ponds are single lined with 30 mil PVC. Ponds 11S, 12S, and 13S were designed and constructed to overflow through a pipe to the adjacent pond,

preventing overtopping. To maintain a foot of freeboard, pond levels of the following depths are maintained:

| | Depth, inches |
|---|---|
| Pond 11S | 111 |
| Pond 12S | 108 |
| Pond 13S | 105 |

Two feet of freeboard is maintained in Pond 14S.

These levels are measured daily and recorded in the inspection log by the environmental technician. If these levels are exceeded, water is decanted to 15S.

The technician also inspects the two leachate collection wells weekly for leakage. Any leaks through the liner are recorded in the inspection log and operating record. Should a leak occur, the water being removed from the leachate well will be pumped out and returned to the Phase IV pond system. The dikes are inspected weekly to determine if they have been damaged mechanically or by weathering. If damage occurs, the dike is repaired with crushed slag. Phossy waste on the pond banks is washed back into the ponds.

Phossy solids are dredged to pond 15S (and in the future to 16S). During the dredging process, the ponds are monitored continuously for leaks and releases.

Appendix D-3 includes specifications for the grading and earthwork, pond liner, and leak detection system for the Phase IV ponds. It also contains soil testing data for the pond dikes.

### D.4.5 Precipitator Slurry Drying Surface Impoundment (Pond 9E) - #WMU #9

Precipitator dust is generated in the electrostatic precipitators which are located downstream from each of the four electric arc furnaces. This dust is slurried with water in the slurry pots and pumped to the precipitator slurry surface impoundment (pond 8E). Pond 8E, an interim storage pond, is designed to hold a one year's supply of slurried dust (see WMU #11).

Precipitator slurry is dredged from pond 8E to the solar drying surface impoundment pond 9E (Drawings D4.5-1 through D4.5-3) during the late fall and winter months. The piping system is designed to distribute slurry evenly over the bottom of the pond, which covers an area of 12.9 acres and has a capacity of 73 acre-feet. It takes approximately two or three months to remove all the slurried material from pond 8E. Once pond 8E is emptied and dredging is complete, no additional slurry is added to pond 9E. During a one- to two-month period, the solids are allowed to settle to the bottom of the pond. After the solids have settled, surface water is decanted from pond 9E

into pond 15S. During the heat of the summer, when most of the water has been decanted, the slurry is solar dried. Equipment designed to stir the waste speeds up the drying process. After the material has been dried, it is excavated with front-end loaders and removed from the pond using 50-ton haul units. It is transported to the precipitator dust storage pile (area 9S).

Management Practices

As precipitator slurry is pumped to pond 9E, the pond freeboard is maintained at a level 2 feet below the top of the PVC liner. To maintain this freeboard, a distance of at least 144 inches (measured from the installed measuring stake to the pond surface) must be maintained. This level is measured daily and recorded in the inspection log by the environmental technician. The technician also inspects the six monitoring wells weekly for water leaks. Any leaks through the liner are recorded in the inspection log and operating record. Should a leak occur, the water being removed from the monitoring well is pumped out and returned to pond 9E. The dikes are inspected daily to determine if they have been damaged. If damage occurs, the dike is repaired with crushed slag.

The precipitator dust from the electrostatic precipitators is slurried in the slurry pots and pumped to pond 8E where it is collected and stored for up to one year. A Mud Cat® dredge pumps the slurried dust to pond 9E where it is evenly distributed over the bottom of the pond. Two operators are responsible for the dredging/pumping operation. The pond operators inspect the pumping lines daily for leaks or damage. Pumping the slurry from 8E to 9E takes about two to three months. Once settling is complete, the water is decanted from the pond and the remaining solids are allowed to solar dry. Mobile stirring equipment (known as the Brown Bear®) enters the impoundment periodically to stir the slurry, which speeds up the drying process. In both the dredging and stiring operations, the cabs of the equipment are monitored for phosphine gas. Respirators are supplied for the operators in both pieces of equipment. An equipment cleaning pad is located in the southwest corner of pond 9E for decontaminating equipment.

The pond operator notifies the Burden business unit manager when he determines that the dust is dry enough to transport. The 992 loader and 50-ton haul units are used to remove the dried precipitator dust from the pond. Phosphine monitors and canister-type respirators are provided in each loader and haul unit. Pond 9E has a ramp at the southwest corner for safe access to the bottom of the pond. Roadways used for transport of the precipitator dust from the pond to the storage area are graded to reduce the potential for releases. The plant water tanker is used to wet the roadways, precipitator dust storage pile, and bottom of pond 9E to minimize fugitive dust.

When the proper administrative arrangements have been made, road preparation has been completed, and the gates have been opened, the loader

and haul units enter the impoundment and begin digging and removing the precipitator dust. The loader operator is extremely careful when digging the material so as not to damage the top pond liner. To minimize releases, the haul units are not overloaded. The loaded haul units move out of pond 9E and proceed to the precipitator dust storage pile (area 9S). The haul units dump their loads at the storage pile site. A front-end loader is used to consolidate the precipitator dust to effectively utilize the storage area. The haul units keep their speed down to control fugitive dust and prevent road wear. Because the road is narrow, only one truck can safely enter the storage area at a time.

To determine the amount of material transported, the first loaded haul unit is weighed. After the weight of a loaded haul unit is recorded, the number of loads are counted and recorded daily. The total amount of material transported is calculated and recorded in the operating record.

When all the precipitator dust has been removed from pond 9E, the bottom of the pond is prepared for a new supply of precipitator slurry. Work includes grading the bottom of the pond as necessary and setting out the slurry distribution piping.

Appendix D-4 includes specifications and test reports for the pond liner and specifications for the roadways, grading and earthwork, and leak detection system.

### D.4.6 Phossy Waste Surface Impoundment (16S) - WMU #10

WMU #10, pond 16S, is a planned pond that will function as an alternate to pond 15S. It will be constructed to meet RCRA requirements for a waste disposal surface impoundment. It will include a containment pad and barrel dumping facility that empties phossy wastes contained in drums. The pond will be slightly larger (10.2 acres) than pond 15S. It will hold approximately 150 acre-feet of phossy wastes, decant water from the precipitator slurry drying pond 9E, and waste water liquor from pond 8S.

The management practices for 16S will be the same as for 15S. Pond freeboard level will be maintained at 2 feet, the pond will be inspected daily, and pond level measured daily. Leak detection monitoring wells will be installed, and a technician will inspect these weekly for evidence of leaks from the pond. The required groundwater monitoring wells will also be installed.

### D.4.7 Precipitator Slurry Surface Impoundment (Pond 8E) - WMU #11

WMU #11, pond 8E, receives precipitator slurry from the furnace electrostatic precipitators. The 2.8-acre pond (Drawings D4.7-1 through D4.7-3) is double lined with 30 mil PVC; it holds approximately 27 acre-feet of precipitator

slurry. In the pond, the suspended solids settle out, are mechanically distributed throughout the pond, and are dredged periodically to pond 9E.

The pond freeboard is maintained at 2 feet below the top of the PVC liner. The environmental technician measures this level daily and records it in the inspection log. If this level is exceeded, water is decanted to pond 15S. If the level is too low, water is accepted from 15S. The technician also inspects the leachate collection well weekly for leakage. Any leaks through the liner are recorded in the inspection log and operating record. Should a leak occur, the liquid is pumped out and returned to pond 8E. The dikes are inspected weekly to determine if they have been damaged. If damage occurs, the dike is repaired with crushed slag.

All pond dredging activities and pond piping are inspected daily for releases and leaks.

Appendix D-5 includes specifications for the pond liner, roadways, grading and earthwork, and the dredging equipment used in pond 8E.

## D.5 INCINERATORS [270.19, 264.340 through 264.351]

FMC does not have any incinerators that it uses for treatment, storage or disposal of hazardous wastes. Thus, special requirements for incinerators are not applicable to the permit application.

## D.6 LANDFILLS [270.21, 264.300 through 264.317]

FMC does not have any landfills that it uses for disposal of hazardous wastes. Thus, special requirements for landfills are not applicable to the permit application.

## D.7 LAND TREATMENT [270.20, 264.270 through 264.283]

FMC does not have any land treatment systems that it uses for treatment of hazardous wastes. Thus, special requirements for land treatment units are not applicable to the permit application.

## D.8 MISCELLANEOUS UNITS [270.23, 264.600 through 264.603]

Two above-ground hazardous waste miscellaneous treatment systems are included in this permit application. Pond 8S recovery process (WMU #4) recovers elemental phosphorus for product from waste solids in pond 8S. The waste water treatment unit (WMU #12) treats Medusa scrubber and calciner scrubber blowdown for cadmium before discharge to on-site surface impoundments.

### D.8.1 Pond 8S Recovery Process - WMU #4

The pond 8S process is a proprietary process that has been patented by FMC. The following detailed description of the process is taken from the patent document, except as modified to reflect current process information. FMC developed the drawings represented as Figures I through III as a means of providing a sufficiently detailed description of the process without the necessity of disclosing the most sensitive of the proprietary information relating to the process. FMC is prepared to make further details of the process available, if necessary, consistent with the protection of confidential information afforded by 40 CFR 270.12 and 40 CFR Part 2.

*This text is modified from Patent Document No. 4,492,627 to reflect current process information.*

**ABSTRACT**

Process for recovery of elemental phosphorus from waste ponds by dredging the waste pond to obtain an aqueous phosphorus slurry, separating particles larger than 2 mm from the slurry, treating the remaining slurry in an initial hydrocyclone and removing an underflow of solids larger than 150 micrometers, treating the overflow from the initial hydrocyclones in smaller diameter hydrocyclones, removing a second overflow enriched in slimes and diminished in phosphorus, removing a second underflow enriched in phosphorus and diminished in slimes and heating it sufficiently to melt the phosphorus therein, treating the heated second underflow in a centrifugal separator, and separating and recovering a stream of coalesced phosphorus from a heavy fraction of impurities.

**Recovery of Phosphorus from Waste Ponds**

The present invention relates to a process for the recovery of elemental phosphorous from waste ponds which are formed during the process of producing phosphorus from phosphate ores. In conventional operations, elemental phosphorus is produced by reacting phosphate ore with carbon at high temperature in an electric furnace. In the operation of such furnaces, the phosphate ore is typically agglomerated, calcined and fed into the furnace with coke to supply carbon, and silica to act as fluxing agent. Graphite electrodes suspended within the furnace are in contact with the furnace feed and form a

melt zone at the base of the electrodes where the phosphate ore is reduced to phosphorus.

In order to prepare the phosphate ore for use in the furnace, the ore is crushed, agglomerated by briquetting or pelletizing, and then is sintered or calcined into compact shapes to remove volatile elements from the ore. This procedure for preparing phosphate ore into briquettes suitable for use in a phosphorus furnace, is described in U.S. Pat. No. 3,760,048 issued on Sept. 18, 1973 in the names of James K. Sullivan et al.

The resulting phosphorus which is formed is vaporized, removed from the furnace, cleaned by electrostatic precipitators and condensed in one or more condensation steps by direct contact with water to form an aqueous slurry of phosphorus. The resulting phosphorus condensate separates when settled in collection sumps or tanks into three layers; a bottom layer of the desired elemental phosphorus, an intermediate layer of phosphorus sludge, and an upper layer of water containing dissolved phosphorus and fine particulate phosphorus.

The phosphorus sludge layer is an emulsion of phosphorus and water with varying amounts of fine dirt slimes mostly in the water phase, and some larger, gritty, abrasive material. The average composition is about 50% by weight phosphorus, 40% by weight water and about 10% by weight dirt. The phosphorus sludge emulsion is believed to be stabilized mainly by very fine dirt slimes which separate the phosphorus globules and by polymeric phosphorus sacs around the globules with the indicated formula $(P_4OH)_n$. These sacs form a membrane around the globules. The outer surface is hydrophilic (attracted to water) and along with the slimes prevents globule coalescence.

Organic tars and dirt trapped within the condensed phosphorus globules are additional stabilizing agents. The fine dirt from the electric furnace is carried with the gas through the electrostatic precipitators. It is believed that the polymeric phosphorus sacs are formed typically from air leakage into the furnace, precipitator, and condenser system.

To recover the phosphorus from the phosphorus sludge, prior workers utilized such techniques as decantation (to permit as much phosphorus as possible to settle from the sludge layer), distillation of the sludge to vaporize the phosphorus, flocculating agents to settle the sludge such as animal glue, alum and the like and finally, centrifugation of the sludge to separate the phosphorus content of the sludge layer. An additional treatment is oxidation of the film by oxidizing agents, for example, chromic acid and the like. Of these, centrifugation appears to be cost effective for separating the greatest amount of phosphorus possible commensurate with the expense and time for carrying out such sludge treatment. This is described in U.S. Pat. No. 3,084,029 issued on Apr. 2, 1963 in the names of Barber et al.

In this process of centrifuging the phosphorus sludge to recover phosphorus, unfortunately, small phosphorus globules are unavoidably swept up and out of the centrifuge along with the slimes. The phosphorus thus lost, in amounts up to 15%, is a substantial amount of the feed phosphorus which,

after being unavoidably swept out with slimes into the centrifuge waste water stream, is placed in outside waste ponds for storage.

The phosphorus in these centrifuge waste water ponds settles, cools and solidifies with trapped dirt and becomes even more difficult to recover. Because it has not been found possible to recover such waste phosphorus, heretofore, the phosphorus contents thereof have been ignored as a valuable asset.

Attempted recovery processes have been difficult because of the properties of phosphorus and its physical condition in the ponds. Much of the phosphorus exists as a viscous ooze of finely divided frozen phosphorus particles and dirt slimes, but the rich deposits near the banks are frozen into hard layers or sometimes huge blocks of solid, pure phosphorus, the whole being contaminated with sand, rocks and natural debris. Phosphorus burns on contact with air, so that the ponded material cannot be dried and excavated with normal earth moving equipment, but must be handled as a water slurry, with some of the processing equipment sealed with inert atmosphere. Safety of plant personnel is also of paramount importance because of the very hazardous nature of the material.

Accordingly, it is most desirable to find a technically feasible, economically sound process for recovering such waste phosphorus in order to reduce the amount of phosphorus lost in such ponds and to minimize any environmental problems by diminishing the size and number of such waste ponds.

In accordance with the present invention, it has been found that phosphorus can be recovered from these waste ponds by dredging the waste pond to obtain an aqueous slurry containing comminuted phosphorus-containing particles, screening an oversize fraction containing particles larger than about 2 mm from an undersized fraction in said slurry, feeding the undersized fraction of said slurry into an initial hydrocyclone and removing a first underflow stream having phosphorus-containing solids larger than about 150 micrometers, removing a first overflow stream from said initial hydrocyclone rich in phosphorus and slimes, introducing the first overflow stream into a plurality of hydrocyclones, each having a diameter less than the initial hydrocyclone, removing a second overflow stream from at least one of the plurality of hydrocyclones diminished in phosphorus and enriched in slimes, removing a second underflow stream from at least one of the plurality of hydrocyclones enriched in phosphorus and diminished in slimes, heating this second underflow stream sufficiently to melt the phosphorus therein, introducing the second underflow stream containing molten phosphorus into a centrifugal separator, removing a coalesced phosphorus stream as product from said separator and a heavy fraction of dirt containing minor amounts of residual phosphorus as a waste stream.

In a preferred embodiment of the invention, the over-sized fraction containing particles larger than about 2 mm is heated above the melting point of phosphorus and screened to separate an aqueous dispersion of molten phosphorus from particles of dirt larger than 2 mm. The aqueous dispersion of molten phosphorus is directed to a melting and centrifuge feed tank (#46 in FIG. I), and the undersize

fraction of said slurry, previously separated, is directed into the initial hydrocyclone.

**Brief Description of the Drawings**

In the drawings, FIG. I illustrates a flow sheet for carrying out the process steps of the present system.

FIG. II illustrates details of the cutting auger and suction intake device used for pond dredging.

FIG. III illustrates operation of hydrocyclones used to separate phosphorus from slimes.

The present invention can best be described with reference to the attached drawings. In FIG. I of the drawings, there is shown a schematic of the flow sheet for carrying out the present system. In the present process, the waste pond 2 is treated by dredging the bottom of the pond to remove solidified phosphorus and dirt. As shown in FIG. II, this is best done by mounting a cutting auger 4 on a barge (not shown) and lowering the auger 4 to the bottom of the pond where it can cut and chop up the solidified phosphorus and dirt into small pieces. Mounted behind the cutting auger 4 is a suction intake 6 connected to a pump 8 which gathers up the pieces of comminuted solidified phosphorus and solidified dirt. This slurry is then pumped to the shore by means of floating conduits (not shown) connecting the barge and the treating equipment on shore. It has been found useful to use a grid 10 in front of the suction intake to prevent excessively large particles from being taken up by the suction intake to avoid plugging the pump.

As shown in FIG. I, the slurry of comminuted phosphorus-containing particles is then conveyed by pipe 12 to a screen 14 to remove particles larger than about 2 mm in diameter. Removal of these larger particles of solidified phosphorus and solidified dirt is necessary to prevent plugging the downstream equipment used to treat the smaller phosphorus-containing particles. In the preferred embodiment, these larger particles are then passed via line 16 into a melter/disintegrator unit 18 in which they are treated with hot water from line 20. During this treatment, these larger particles are subject to agitation in melter 18 with a rotating screw and are kept in contact with the hot water for a period sufficient to melt the phosphorus in the particles. The resulting dirt from the top of the melter 18 is then passed via line 22 to a second screen 24 where the oversize particles of sand and other non-meltable components are separated from the attached molten phosphorus and finer dirt. The non-meltable particles are removed via line 26 to waste while the molten phosphorus and finer dirt are passed via line 28 to freezing contactor 30. In the freezing contactor 30, the molten phosphorus slurry is treated with cold water via line 68 to freeze the phosphorus to a solid state and thereby form a slurry of the solid phosphorus.

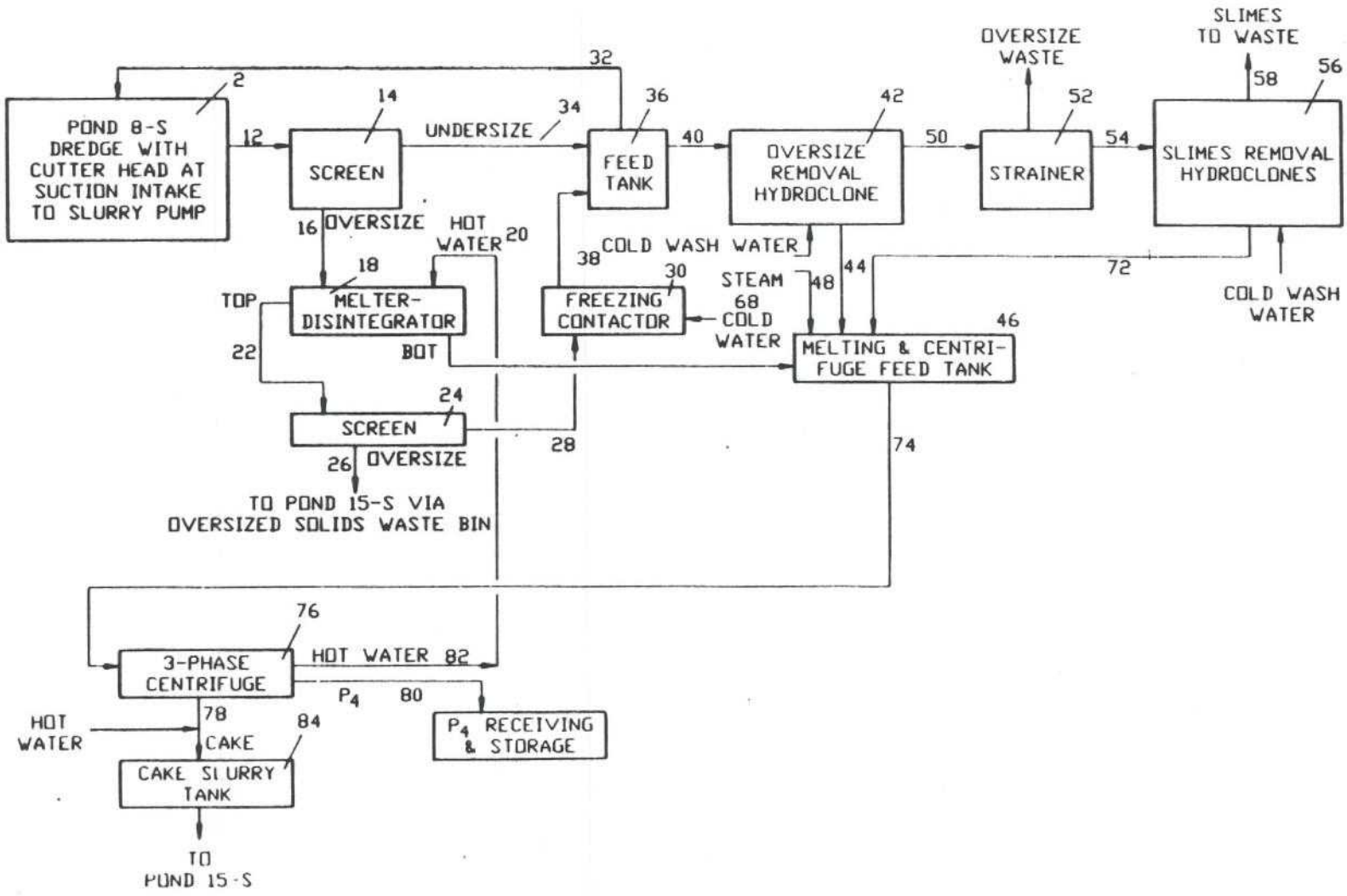

POND 8-S DREDGE WITH CUTTER HEAD AT SUCTION INTAKE TO SLURRY PUMP
2
12
SCREEN
14
UNDERSIZE
34
FEED TANK
36
32
OVERSIZE REMOVAL HYDROCLONE
42
40
STRAINER
52
50
OVERSIZE WASTE
SLIMES REMOVAL HYDROCLONES
54
58
56
SLIMES TO WASTE
16 OVERSIZE
HOT WATER 20
18
MELTER-DISINTEGRATOR
TOP
22
BOT
38 COLD WASH WATER
FREEZING CONTACTOR
30
STEAM 68
COLD WATER
48
44
72
COLD WASH WATER
46
MELTING & CENTRI-FUGE FEED TANK
74
24
SCREEN
28
26 OVERSIZE
TO POND 15-S VIA OVERSIZED SOLIDS WASTE BIN
76
3-PHASE CENTRIFUGE
HOT WATER 82
P4 80
P4 RECEIVING & STORAGE
HOT WATER
78
CAKE
84
CAKE SLURRY TANK
TO POND 15-S

Figure I

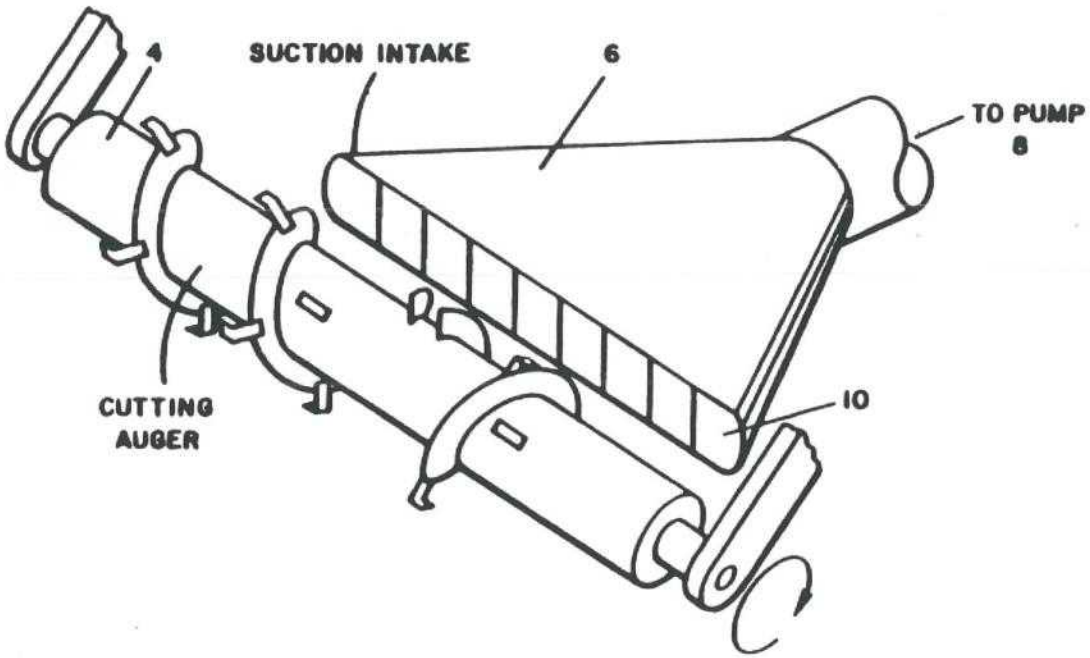



Figure II

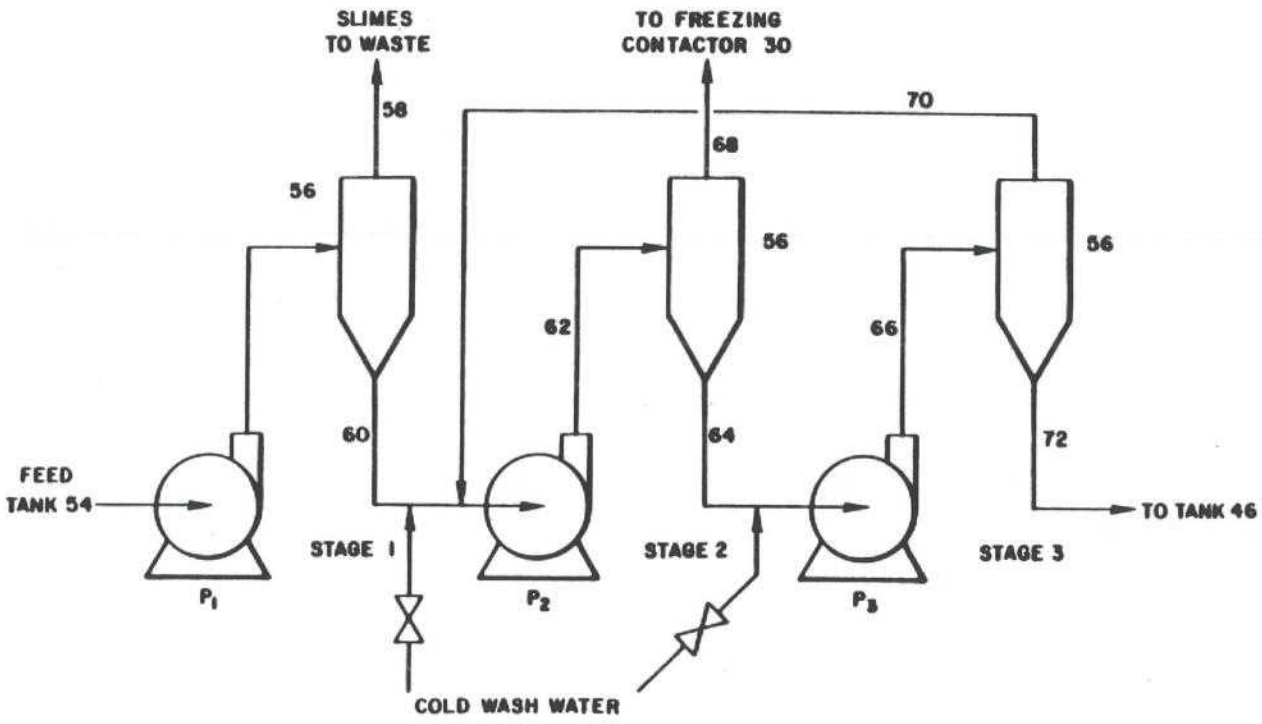

SLIMES
TO WASTE
TO FREEZING
CONTACTOR 30
58
70
68
56
56
56
62
66
60
64
72
FEED
TANK 54
TO TANK 46
STAGE 1
STAGE 2
STAGE 3
P1
P2
P3
COLD WASH WATER

Figure III

The molten phosphorus from the bottom of the melter 18 is directed to the melting and centrifuge feed tank 46.

The above treatment of oversized particles (larger than 2 mm) is to separate many larger pieces of relatively pure phosphorus directly without having to put sand and gravel associated with such phosphorus through the entire recovery system. However, if it is desired to obviate the above treatment, it is possible to treat these oversized particles to a simple grinding step and add the ground particles, smaller than 2 mm, directly to the undersized stream for processing as set forth hereinafter.

The fine particles of about 2 mm and smaller which are removed as the undersized fraction 34 from the first screen are then passed into a feed composition tank 36 along with the phosphorus from line 38 that has been treated in the freezing contractor 30. To prevent plugging of lines, the aqueous slurry of frozen phosphorus and dirt is continually pumped at a high rate through the conduits feeding the feed composition tank 36. Any resulting overflow from tank 36 is recycled back to waste pond 2 via line 32. The aqueous slurry of frozen phosphorus and dirt in the feed composition tank 36 is then passed via line 40 to a hydrocyclone 42 to effect a separation of particles larger than about 150 micrometers from those smaller than 150 micrometers.

In general, hydrocyclones having a diameter of about twenty inches (508 mm) has been found acceptable for this purpose. This separation is necessary to remove larger particles which are essentially solidified phosphorus and solidified dirt from the very fine slimes and fine phosphorus particles which later are treated downstream in smaller hydrocyclones and must be free of larger particles to avoid plugging these smaller hydrocyclones.

The underflow stream 44 from this hydrocyclone containing the larger particles of solidified phosphorus and solidified dirt is passed into a phosphorus melting tank 46 where it is treated with steam via line 48 to melt the phosphorus contained in this fraction. The overflow stream 50 from the hydrocyclone 42 containing the fine dirt slimes and the fine particles of frozen phosphorus is passed into a strainer 52 and from there via line 54 into the first stage of a series of hydrocyclones 56. The hydrocyclones 56 used in this stage and also in the following stages are hydrocyclones each of which has a diameter preferably not above about one inch (25.4 mm). The aqueous stream of frozen phosphorus particles and slimes 54 is introduced under a sufficient pressure drop across the hydrocyclones 56 to separate particles into two separate streams, one having phosphorus-rich particles above about 8-15 micrometers, and another phosphorus-poor particles below about 8-15 micrometers.

The hydrocyclone is a cone shaped unit with a tangential opening in its side so that the material fed into the opening rotates and generates high centrifugal forces, forcing heavier material to be separated in a stream through an opening in the apex of the hydrocyclone (called the "underflow") while the lighter material is removed in a second stream through an opening in the head (called the "overflow"). In the present process, the hydrocyclone is operated so that the

separatory point between the particles is in the range of 8-15 micrometers, thereby assuring that the major portion of phosphorus entering the hydrocyclones is removed in the underflow streams while the overflow streams from the hyrocyclones contain the slimes fraction with extremely small amounts of phosphorus. A pressure drop of from 20 to 40 psi (138-276 kilopascals) measured from the hydrocyclone inlet to the overflow exit has been found effective to achieve this separation. In order to use small cyclones of this type in a plant, they are usually set up in parallel in each stage with a common header so that banks of hydrocyclones can be used to process large volumes of feed normally encountered in the plant. Each of the remaining stages of hydrocyclones are connected in series and washed countercurrently as shown in FIG. III, and as described below.

The fine frozen phosphorus particles and slimes from line 54 are conveyed by pump $P_1$ to the first stage of hydrocyclones 56. The overflow 58 from the hydrocyclones 56 of stage 1, containing mostly slimes with very small amounts of phosphorus, is removed and sent to a waste storage pond. The underflow 60 from the stage 1 hydrocyclones 56 containing the bulk of the phosphorus fed to these hydrocyclones is passed through pump $P_2$ to the inlet 62 of the stage 2 hydrocyclones 56, and the underflow 64 from stage 2 hydrocyclones is in turn passed through pump $P_3$ via line 66 to the stage 3 hydrocyclones.

The overflow 68 from the stage 2 cyclone is used to supply the cold water employed in the freezing contactor 30 to freeze liquid phosphorus. In this way, the overflow 68 eventually becomes recycled in part to line 54 as part of the aqueous phosphorus particles slurry entering hydrocyclones 56. The overflow 70 from the hydrocyclones stage 3 is recycled back to line 60 and the prior stage 2 hydrocyclones. Cold wash water is added to lines 60 and 64 to facilitate separation in the hydrocyclones and to prevent clogging of the system. The effect of putting these stages of hydrocyclones in series is to increase the efficiency in separation of slimes from phosphorus particles. The overflow from these hydrocyclones preferably is put in counter-current flow to the feed and such counter-current design minimizes the amount of wash water required to achieve efficient separation of slimes from phosphorus. The underflow from the stage 3 hydrocyclones 72, containing the bulk of the phosphorus separated in the hydrocyclones, is then passed to the phosphorus melting tank 46 and treated with steam to melt the phosphorus in the aqueous slurry by heating it above the melting point at 112°F. (44°C.) preferably to 140°F. (60°C.).

It should be noted that in carrying out this procedure, the separation of phosphorus particles from the slimes is done while the phosphorus is in a solidified form without having to heat the stream which is being passed through the hydrocyclones. This is important because it eliminates large heat requirements which would otherwise be necessary if heating of the entire slurry were required for carrying out the separation of slimes from phosphorus particles. In addition, the aqueous stream 58 which is removed from the stage 1 hydrocyclones through the overflow contains about 3/4 of the entire volume of feed slurry which is being processed in this system. Thus, the amount of feed slurry which must be heated in order to melt the phosphorus contained therein is reduced to only a quarter of the volume of recovered slurry, and with it the necessary heat load required to effect phosphorus melting.

The aqueous suspension in the phosphorus melting tank containing globules of phosphorus, heavy dirt, and other solids, is then passed via line 74 into a centrifuge 76 designed to break emulsions and concurrently remove solids. In the centrifuge 76, a first stream 78 of heavy dirt solids is removed as waste; a second stream 80 of relatively pure phosphorus is recovered; and a third stream 82 of phossy water is separated. The purified phosphorus stream 80 is sent to storage while the hot phossy water 82 is sent to a water recycle tank (not shown) for use in distributing hot phossy water which is required, such as to line 20 for use in melter 18. The heavy dirt solids stream 78 from the centrifuge, which contains some trapped phosphorus that is unable to be separated in the centrifuge, is slurried with hot water from a hot water generator in a tank 84 and pumped to a waste storage pond for disposal.

The following example is given to illustrate the invention and is not deemed to be limiting thereof.

**Example***

In carrying out the present invention in accordance with the flow sheet set forth in FIGS. I and III, for recovery of about 13 thousand pounds of phosphorus per hour (99 Kg/sec), the following table indicates the major streams in the process and the contents of these streams in the practice of the process. Water additions at various stages in the process are not shown but are included in the total flow rate of the indicated streams.

In the attached table, note that in the hydrocyclone treating stage, stream 72 leaving the hydrocyclones contains 97.48% of the phosphorus entering the hydrocyclones via stream 54, indicating a high efficiency removal of phosphorus from the last of the series of hydrocyclones being fed. The overall phosphorus recovery efficiency is 85.2% Actual operating experience indicates the overall process $P_4$ recovery efficiency and $P_4$ recovery rate vary considerably with the quality of ponded feed material, but are generally less than the figures given here.

Pursuant to the requirements of the patent statutes, the principle of this invention has been explained and exemplified in a manner so that it can be readily practiced by those skilled in the art, such exemplification including what is considered to represent the best embodiment of the invention. However, it should be clearly understood that, within the scope of the appended claims, the invention may be practiced by those skilled in the art, and having the benefit of this disclosure, otherwise than as specifically described and exemplified herein.

A complete discussion on groundwater quality can be found in Section E. Releases from this unit will not reach any surface water in the vicinity of the plant.

---

*Note: Recovery rates, flow rates and efficiencies given in this example and the attached table are taken from process design information and may not represent actual operating values.

## TABLE

### ENGLISH UNITS

| | Stream No. | | | | | |
|---|---|---|---|---|---|---|
| | 12 | 16 | 22 | 26 | 28 | 32 |
| Flow Rate (gpm) | 786.1 | 8.9 | 94.3 | 0.4 | 94.3 | 300 |
| $P_4$ Content (thousand lbs/hr) | 21.58 | 6.9 | 6.9 | 0.138 | 6.77 | 6.15 |
| Dirt Content (thousand lbs/hr) | 64.7 | 1.7 | 1.7 | 0.345 | 1.38 | 21.3 |
| Temperature (°F) | 50 | 50 | 134 | 134 | 134 | 59 |

| | 34 | 38 | 40 | 44 | 50 & 54 | 58 |
|---|---|---|---|---|---|---|
| Flow Rate (gpm) | 776.6 | 275.6 | 751.8 | 23.4 | 747.3 | 574.5 |
| $P_4$ Content (thousand lbs/hr) | 14.67 | 6.89 | 15.4 | 3.08 | 12.33 | 0.185 |
| Dirt Content (thousand lbs/hr) | 63.0 | 11.7 | 53.36 | 1.03 | 52.33 | 34.54 |
| Temperature (°F) | 50 | 83 | 59 | 56 | 59 | 59 |

| | 60 | 62 | 64 | 66 | 68 | 70 |
|---|---|---|---|---|---|---|
| Flow Rate (gpm) | 172.8 | 318.0 | 136.7 | 238.5 | 181.3 | 125.7 |
| $P_4$ Content (thousand lbs/hr) | 12.15 | 12.23 | 12.1 | 12.1 | 0.122 | 0.085 |
| Dirt Content (thousand lbs/hr) | 17.79 | 21.85 | 11.6 | 11.6 | 10.3 | 4.05 |
| Temperature (°F) | 59 | 56 | 56 | 53 | 56 | 53 |

| | 72 | 74 | 78 | 80 | 82 |
|---|---|---|---|---|---|
| Flow Rate (gpm) | 112.8 | 144.2 | 28.5 | 15.8 | 99.9 |
| $P_4$ Content (thousand lbs/hr) | 12.02 | 15.1 | 1.97 | 13.1 | - |
| Dirt Content (thousand lbs/hr) | 7.52 | 8.55 | 7.86 | 0.69 | - |
| Temperature (°F) | 53 | 140 | 140 | 140 | 140 |

## TABLE

### METRIC UNITS

| | Stream No. | | | | | |
|---|---|---|---|---|---|---|
| | 12 | 16 | 22 | 26 | 28 | 32 |
| Flow Rate (l/s) | 49.3 | 0.56 | 5.95 | 0.025 | 5.95 | 18.9 |
| $P_4$ Content (kg/s) | 5.99 | 1.92 | 1.92 | 0.038 | 1.88 | 1.71 |
| Dirt Content (Kg/s) | 17.98 | 0.47 | 0.47 | 0.096 | 0.38 | 5.92 |
| Temperature (°C) | 10 | 10 | 57 | 57 | 57 | 15 |
| | 34 | 38 | 40 | 44 | 50 &54 | 58 |
| Flow Rate (l/s) | 50.0 | 17.4 | 47.4 | 1.48 | 47.1 | 36.2 |
| $P_4$ Content (kg/s) | 4.075 | 1.91 | 4.28 | 0.86 | 3.425 | 0.051 |
| Dirt Content (Kg/s) | 17.5 | 3.25 | 14.8 | 0.09 | 14.54 | 9.59 |
| Temperature (°C) | 10 | 28 | 15 | 14 | 15 | 15 |
| | 60 | 62 | 64 | 66 | 68 | 70 |
| Flow Rate (l/s) | 10.9 | 20.1 | 8.62 | 15.0 | 11.4 | 7.93 |
| $P_4$ Content (kg/s) | 3.375 | 3.40 | 3.36 | 3.36 | 0.034 | 0.024 |
| Dirt Content (Kg/s) | 4.94 | 6.07 | 3.22 | 3.22 | 2.86 | 1.125 |
| Temperature (°C) | 15 | 13 | 13 | 12 | 13 | 12 |
| | 72 | 74 | 78 | 80 | 82 | |
| Flow Rate (l/s) | 7.1 | 9.1 | 1.8 | 1.00 | 6.3 | |
| $P_4$ Content (kg/s) | 3.33 | 4.19 | 0.55 | 3.64 | - | |
| Dirt Content (Kg/s) | 2.09 | 2.375 | 2.18 | 0.19 | - | |
| Temperature (°C) | 12 | 60 | 60 | 60 | 60 | |

## PROCESS EQUIPMENT KEY FOR 8-S RECOVERY PROCESS PATENT PATENT NO. 4,492,627: RECOVERY OF PHOSPHORUS FROM WASTE PONDS

| Name of Unit | Ref. No.(1) | Description | Dwg. Ref. |
|---|---|---|---|
| Dredge | 2 | Mud Cat Model MC-915, cutterhead capable of cutting 9' wide and 15' deep, pumps about 800 GPM of slurry | 39928 |
| Primary Screen | 14 | Smico 4' x 10' vibrating screen, 2 screen decks - upper has 1/2" openings and lower has 1/16" openings, equipped with internal sprays for washing | 39928 |
| Melter-Disintegrator | 18 | Modified McLanahan 30" dia. by 20' long coarse material screen washer constructed of steel with explosion vents and internal spray header | 39928 |
| Secondary Screen | 24 | Smico 2' x 4' vibrating screen, 2 screen decks - upper has 1/2" openings and lower has 1/16" openings, equipped with internal sprays for washing | 39928 |
| Freezing Contactor | 30 | Constructed by Krebs Engineers and utilizes a wet cyclone headpiece to generate a rapidly swirling wall of water which the molten material contacts to be sheared and frozen | 3992 |
| Feed Comp Tank | 36 | Capacity = 3760 gallons, construction = 1/4" steel plate | 39975, 39976, 39928 |
| Nearsize Hydroclone | 42 | Krebs 20" dia. hydroclone, apex equipped with cyclo-wash attachment | 39928 |

| Name of Unit | Ref. No.(1) | Description | Dwg. Ref. |
|---|---|---|---|
| Melt Tank | 46 | Capacity = 3000 gallons, construction = 1/4" steel plate, top 5' lined with 10 ga. 316L SS | 39975, 39976, 391200, 391201, 39929 |
| Strainers | 52 | Durco backwash strainers, 6 strainer vessels in parallel, backwash cycle must be initiated manually | 39928 |
| Hydroclones | 56 | Dorr-Oliver 3 stage classification circuit using one inch ceramic cyclones mounted within 5 pressure vessels | 39929 |
| Centrifuge | 76 | Bird 24" x 96" solid bowl LLS centrifuge, SST construction | 39930 |
| Cake Slurry Tank | 84 | Capacity = 680 gallons, construction = mild steel | 39930 |
| $P_4$ Receiver Tank | - | Salvaged railroad shipping tankers, 2 each, capacity = 7000 gallons and 10,000 gallons, heated by external coils | 39930, 85477 |

(1) See patent, Figs. 1 and 3

## D.8.2 Scrubber Blowdown Waste Water Treatment Unit - WMU #12

WMU #12, the scrubber blowdown waste water treatment unit (Drawings D8.2-1 through D8.2-3), is a miscellaneous treatment system for Medusa scrubber blowdown and calciner scrubber blowdown. Appendix D-6 contains a detailed description of the reactor tank, the main component of the waste water treatment unit, including its design, operation, and monitoring. Inspection of this unit is discussed in Section F. Also, in Appendix D-7, a report demonstrates the effectiveness of this unit. It uses slaked lime to adjust the pH of the blowdown from approximately 3.0 to 4.7. This treatment also renders the cadmium in the Medusa scrubber blowdown insoluble so that the discharge stream no longer displays the toxicity characteristic of the Medusa scrubber blowdown. (See treatability study in Appendix D-7.) The stream is discharged to the calciner ponds for clarification and recycle. A description of the hydrology including groundwater chemistry can be found in Section E.

Varying amounts of calciner scrubber water are bled off of the recirculation tank due to changes in evaporation rate in the scrubbers. This water is sent to the treatment reactor tank where it is mixed with Medusa scrubber blowdown, industrial clarified water, and water from the calciner pad sumps. These liquors are treated with slaked lime from a lime slurry tank to maintain a pH of 4.7. The reactor tank is a 20-foot-diameter by 24-foot-high vessel with a working volume of 54,000 gallons. The tank bottom and 18 inches of the tank wall are constructed of 317LM stainless steel. The rest of the tank is lined carbon steel. The lining is an abrasion-resistant, corrosion-resistant reinforced polyester lining. The tank has foil anti-swirl baffles on the interior wall and an overflow nozzle 1 foot below the top of the tank.

The lime slurry tank is an 18-foot-high, 18-inch-diameter carbon steel vessel with a working volume of 21,000 gallons. It has four anti-swirl baffles on the interior wall, pump suction lines 1 foot from the tank bottom, and an overflow nozzle 1.5 feet from the top.

# PAGES CONTAINING CBI HAVE BEEN REMOVED FROM THIS LOCATION

CBI Form #2

# Appendix D-1

Phossy Waste Surface Impoundment (15S)

FMC
$P_4$ Recovery from Pond 8-S Waste Pond PVC Lining
Pocatello, Idaho (Pond 15S)

Project No. C81-08

July 16, 1981

Specification for Pond Liner

## REVISIONS

Each time a new page is added to this specification, or an existing page is revised, only this revisions page reissues with the new or revised pages.

| REV. | DATE | BY | PAGE | REMARKS |
|---|---|---|---|---|
| A | 1/18/79 | MS | All | Issued for Approval |
| O | 6/04/79 | MS | All | Issued for Construction |
| 1 | 7/16/81 | RPR | All | Reissued for Construction |

Specification for Pond Liner

## 1.0 SCOPE

This specification covers the requirements for furnishing and installing a polyvinyl chloride (PVC) plastic bottom and embankment liner, and liner protection blanketing, for the waste pond.

## 2.0 MATERIALS

### 2.1 PVC Materials

The materials furnished under these specifications shall be first quality products designed and manufactured for the purposes of this work and which have been satisfactorily demonstrated by prior use to be suitable and durable for such purposes.

The PVC lining shall consist of standard widths of calendered polyvinyl chloride sheeting, neutral gray to black in color, 30 mils in thickness, and fabricated into the minimum number of large pieces required to fit the facility. The sheeting shall be manufactured from domestic virgin polyvinyl chloride resin and specifically compounded for use in hydraulic facilities. Reprocessed material shall not be used. The PVC materials shall have the following physical characteristics:

| Test | Typical Test Values | Test Method |
|---|---|---|
| Thickness | ± 5% | ASTM-D1593 |
| Specific Gravity | 1.23 | ASTM-D792A |
| Tensile Strength, lbs/in width | 66 | ASTM-D882B |
| Elongation, % min. | 325 | ASTM-D882B |
| 100% Modulus, lbs/in | 30 | ASTM-D882B |
| Elmendorfer Tear, gms | 6000 | ASTM-D1922 |
| Graves Tear, lbs/min | 8.25 | ASTM-D1004 |
| Water Extraction, % max. | 0.15 | ASTM-D1239 |
| Volatility, % max. | 0.75 | ASTM-D1203A |
| Impact Cold Crack, °F | -20 | ASTM-1790 |
| Dimensional Stability, max. % (100°C - 15 minutes) | 5 | |
| Resistance to Burial | | Para. 4C (1) per |
| Tensile Strength Loss | 5.0 | Bur. of Reclamation |
| Elongation Loss | 20.0 | Procedure |

Specification for Pond Liner

4.0 FIELD INSTALLATION - continued

4.4 Completion

All joints, on completion of the work, shall be tightly bonded. Any lining surface damaged due to scuffing, penetration by foreign objects, or distress from rough subgrade shall, as directed by the engineer, be replaced or covered and sealed with an additional layer of PVC of adequate size.

4.5 Liner Anchorage and Protection

4.5.1 Material - Liner protection covering shall consist of a 12 inch layer of earth cover topped by a 6 inch layer of crushed slag, as shown on the drawings.

The material obtained from the pond area excavation shall be suitable for the earth cover, provided all organic material, sticks, trash, and sharp rocks are first removed. No pieces larger than two (2) inches shall be placed within the bottom six (6) inches of this liner anchor material. No piece larger than four (4) inches shall be placed within the top six (6) inches of the anchor material. This material shall be reasonably even graded and free draining.

The crushed slag material shall be as specified in Specification 5000-2, Roadways and Surfaced Areas, for Aggregate Base Course, except that it shall conform to the following limits:

| Passing Sieve Size | Percent by Weight |
|---|---|
| 3-1/2 Inch | 90-100 |
| 2-1/2 Inch | 25- 60 |
| 1-1/2 Inch | 0- 15 |
| 3/4 Inch | 0- 5 |

4.5.2 Application

The liner anchor courses shall be distributed over the area required, as shown on the drawings. The depth shall be as required to provide a finish depth as shown on the drawings after being compacted using compaction equipment to be approved by the engineer. Grading equipment shall not be driven directly on the liner, except as directed by the engineer. The finished surface shall be smooth and true to the line and grade as indicated on the drawings.

Specification for Pond Liner

## 3.0 FACTORY FABRICATION

Individual calendered widths of lining materials shall be fabricated into large sections by solvent bonding into a minimum number of pieces that can be readily handled, as required to fit the installation. Lap joints with a minimum width of 1/2 inch shall be used. Joints shall meet the seam strength of 80 percent of the specified sheet strength. After fabrication, the lining shall be accordion folded in both directions, and packaged for minimum handling in the field.

## 4.0 FIELD INSTALLATION

### 4.1 Preparation

The ponds to receive the lining shall be constructed by others, but shall be the responsibility of the lining contractor to inspect the finished surface and correct any irregularities and deformities which might adversely affect a satisfactory liner installation. All vegetation must be removed. A soil sterilant may be required at the discretion of the engineer.

### 4.2 Lining Application

The lining shall be installed in such a manner as to assure minimum handling. The lining shall be closely sealed around inlets and outlets as shown on the drawings. Any portion of lining damaged during installation, by any cause, shall be removed or repaired by using additional lining material bonded to the in-place liner with the appropriate adhesive (see Paragraph 4.3) according to the manufacturer's recommendations.

### 4.3 Field Joints

Lap joints shall be used to seal factory fabricated pieces of lining together in the field. Lap joints shall be formed by lapping the edges of pieces a minimum of 2 inches. The contact surfaces shall be wiped clean to remove all dirt, dust, moisture, or other foreign materials. Sufficient cold-applied vinyl-to-vinyl adhesive shall be applied to both contact surfaces in the joint area and the two surfaces shall be pressed together immediately. Any wrinkles shall be removed. Ratios of solvents to adhesives shall be in accordance with the manufacturer's recommendations for the lining materials being joined. Field made splices shall have a strength of 80 percent of the specified sheet strength.

# Appendix D-2

## Phossy Waste Surface Impoundment (8S)

# MUD CAT
# machine specifications

## Model MC-915

| | | |
|---|---|---|
| **General:** | Length | -38'11" |
| | Width | -9'0" |
| | Height | -O.A. 8'8" |
| | Weight | -21,000 lbs. Dry |
| | Draft | -21" |
| | Floating Clearance | -6'9" |
| | Fuel Capacity | -360 gallons |
| **Flotation:** | Pontoons—Two 36" x 32" x 33'0" | |
| | 10 Gauge H.R. Steel with Internal Bulkheads and Stiffeners; formed for rigidity; polyurethane foam filled | |
| **Cutter Assembly:** | Auger: | |
| | Diameter | -13-5/8" |
| | Pitch | -11" |
| | Flighting | -3/8" |
| | Speed | -Up to 100 RPM |
| | Cutter Knives—45 Detachable Heat-Treated Blades | |
| | Cutter Bars—36 Detachable Heat-Treated Blades | |
| | Auger Torque—16,500 in. lbs. | |
| | Rotates to Cut Slope up to 45 degrees | |
| **Mud Shield:** | 19" x 9' Hydraulically Adjustable | |
| **Working Capacity:** | Cut 9' wide x 18" maximum depth | |
| | Operating Depth—15' maximum | |
| **Engine:** | Detroit Diesel 6-71 RC | |
| | 228 BHP @ 2100 RPM | |
| **Drive:** | Clutch—Manual, 14" Dia. Disc & Pressure Plate | |
| | Reduction—Gear Ratio 1.8/1—Drive Coupling Flex Type | |
| **Main Pump:** | Centrifugal Closed Impeller | |
| | Impeller Diameter—19-1/2" | |
| | Suction Diameter—8" | |
| | Discharge Diameter—6" | |
| | Shaft Diameter—2-7/8" | |
| | Capacity—2000 GPM @ 1160 RPM against 180' Head | |
| | Material Removal—To 120 cu. yds./hr. | |
| **Service Water Pump:** | Capacity—75 GPM @ 2800 RPM | |
| | Pressure—80 PSI | |
| **Hydraulic System:** | Dual Pumps | |
| | Capacity Total—30.5 GPM @ 1800 RPM | |
| | Reservoir—47 Gallon | |
| | Circuit One—Auger Drive | |
| | Circuit Two—Boom, Mud Shield and Winch | |
| | Relief Valve Setting | |
| | Auger -3000 PSI | |
| | Others -1500 PSI | |
| **Propulsion:** | Treble Sheave Hydraulic Winch | |
| | Traverse Speed -50 FPM Maximum Forward & Reverse | |
| | Average Cutting Speed -8 to 12 FPM | |
| **Electrical System:** | Voltage—12V | |
| | Alt. Output—65 Ampere | |
| | Batteries—12V, 205 Ampere Hour, Parallel Wired | |
| | Circuits—2 Wire System Full Ground | |
| **Coating:** | Polyurethane finish coat on corrosion inhibitive epoxy primer | |
| **Standard Colors:** | Standard Colors—Green and White | |

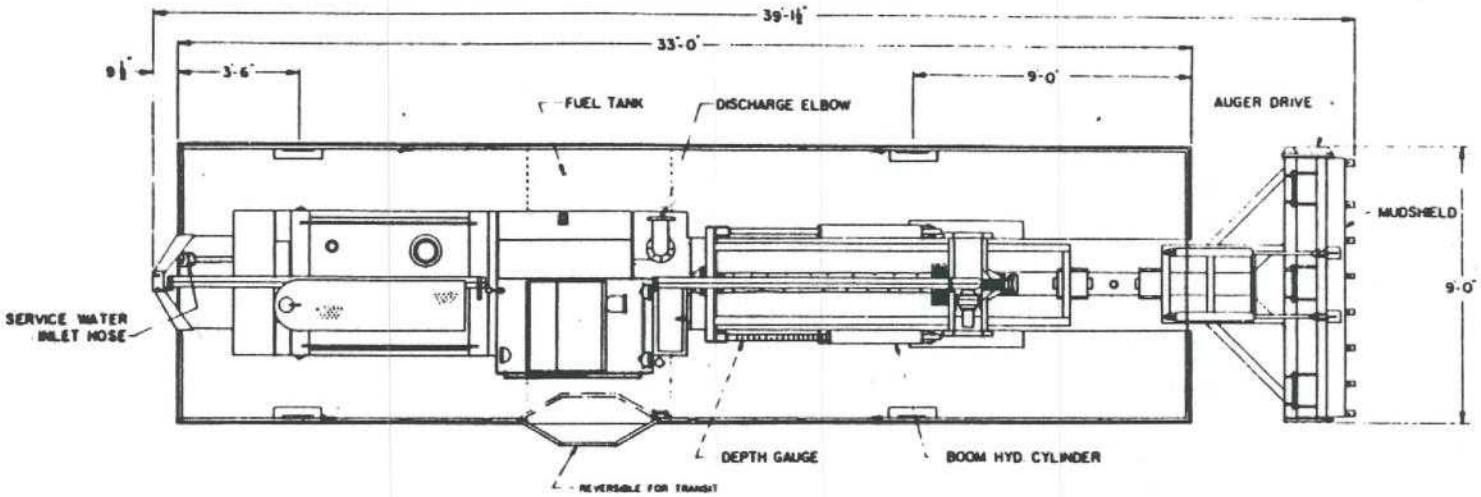
MUD CAT machines are operating in a growing list of countries throughout the world. To obtain complete information, call the MUD CAT Division of National Car Rental System, Inc., toll-free at 800/328-7333. In Minnesota call collect 612/893-6400 or telex 29-0767. Or write:

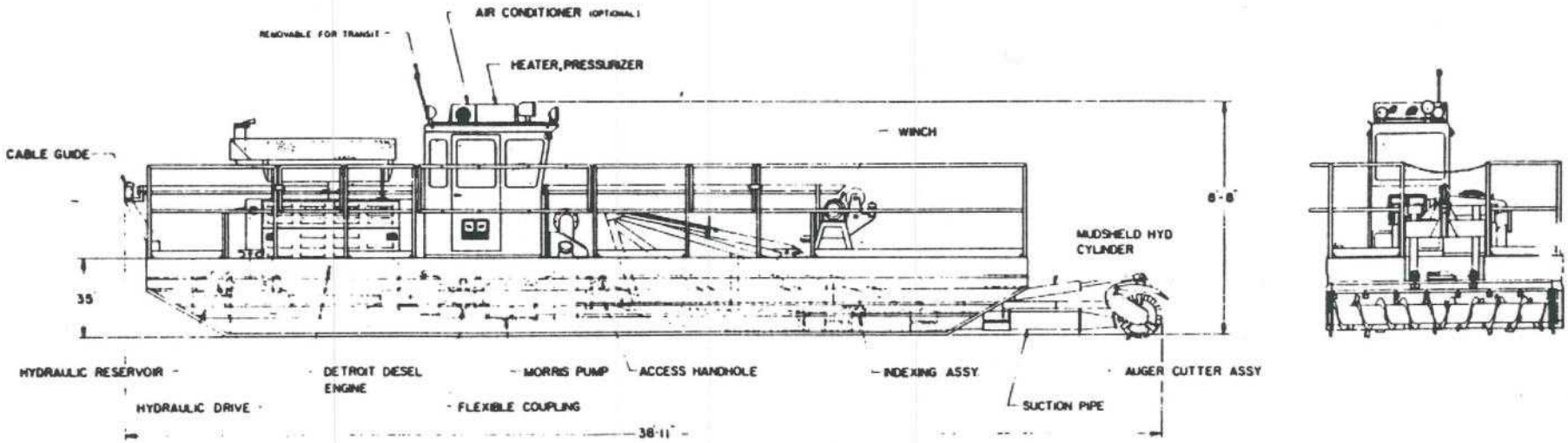
(301) 837-7900

MUD CAT
NATIONAL CAR RENTAL

MUD CAT Division
National Car Rental System, Inc.
P.O. Box 16247
St. Louis Park, Minn. 55416

MC915-92080-E




MUD CAT MODEL MC

DATE 5-30-79

MC915 92080 E

# Appendix D-3

Phossy Waste Clarifier
Surface Impoundments
(11S, 12S, 13S, and 14S)

| FMC<br>Phossy Water Project<br>Pocatello, Idaho | Clarifier & Surge Ponds<br>[redacted] | Project No. 02-2092<br><br>January 17, 1979 |
|---|---|---|

Specification No. 5000-1

## REVISIONS

Each time a new page is added to this specification, or an existing page is revised, only this revisions page reissues with the new or revised pages.

| REV. | DATE | BY | PAGE | REMARKS |
|---|---|---|---|---|
| A | 1/17/79 | MS | All | Issued for Approval |
| 1 | 7/31/79 | RLA | 2 | Par. 5.0 |

Specification No. 5000-1

## 1.0 SCOPE

This specification covers the requirements for all excavation, grading and associated operations for the Clarifier and Surge Ponds. Excavation for buildings and underground piping is specified in other sections.

## 2.0 STANDARDS

### 2.1 ASTM Standards

| | |
|---|---|
| D-1556-64 | Density of Soil in Place by the Sand Cone Method |
| D-1557-70 | Moisture-Density Relations of Soils Using 10 Lb. Rammer and 18 Inch Drop |
| D-2167-66 | Density of Soil In Place by the Rubber Balloon Method |

### 2.2 Uniform Building Code, 1976

### 2.3 Latest edition of the Standards of the Occupational Safety and Health Administration (OSHA)

## 3.0 SOILS ENGINEER

To assist the earthwork subcontractor in meeting specifications, the soils engineer shall be present to conduct density checks, to determine the quality of on-site soils, to inspect and approve imported fill materials and to carry-out such tests as may be required.

## 4.0 LAYOUT OF WORK

The subcontractor shall establish and maintain lines, levels and centers required for the proper performance of all operations. The subcontractor shall verify the accuracy of the horizontal and vertical control reference points provided by the owner and, if necessary, establish a bench mark for future base reference.

## 5.0 EXCAVATION

The pond shall be stripped of mud, debris, and organic matter to the approximate depth of the proposed pond.

Specification No. 5000-1

5.0 EXCAVATION - continued

Such unsuitable material shall be disposed of on-site as directed by the engineer. Near surface compressible soils shall be excavated and recompacted if more than one foot thick, or compacted in place if less than one foot thick. The exposed subgrade shall be scarified to a depth of 12 inches, moistened as required to obtain optimum moisture, and compacted as specified.

Excavated slopes shall be finished in conformance with the lines and grades shown on the plans. All debris and loose material shall be removed.

Excavation shall be performed in a manner and sequence that will provide drainage at all times. Excavation shall be kept free from water while construction is in progress.

Surplus excavated material shall be disposed of on-site as directed by the engineer.

6.0 EMBANKMENTS

Excavated on-site material is considered satisfactory for reuse in the controlled fill. Fill material shall be free of organic material, trash, and stones greater than six inches in maximum dimension. In some cases large rocks, boulders, or hard lumps over six inches in diameter that have been excavated from the site, may be incorporated into the fill subject to the approval of the engineer. The location, depth, and method of its placement shall be approved by the engineer. Imported fill shall be non-expansive and approved by the engineer prior to use. Areas over which fills are to be placed shall be scarified to provide a bond between existing ground and fill material. Fill and backfill shall be placed in successive horizontal layers not exceeding 12 inches in loose thickness at optimum moisture content. Precise lift thickness is contingent upon the type of compaction equipment used and shall be determined by the engineer. Fill and backfill shall be placed in a manner and sequence that will provide drainage at all times during construction.

Each layer of fill shall be compacted using medium to heavy vibratory compaction equipment to be approved by the engineer. At the time of compaction, the moisture content of the fill material shall be controlled so as to obtain the specified compaction. Interior embank-

Specification No. 5000-1

6.0 EMBANKMENTS - continued

ment slopes shall be dressed smooth and rolled to receive the lining material.

Pond dikes shall be compacted to at least 95% relative compaction. The words "relative compaction" used herein and on the construction plans, shall be defined as the ratio of field dry density to the laboratory maximum dry density as determined by ASTM D-1557. Compaction to 90% will suffice for areas not supporting roadways or other structures.

The finished top of dike surface (excluding the roadway surface) shall not vary more than 0.10 foot from the established grade and cross section.

7.0 POND BOTTOM

The prepared surface that will receive the liner shall be free from roots, brush, loose earth, rock, cobbles, rubbish, or other foreign materials. Rock ledges, or immovable objects shall be covered with a minimum of six inches of sand or compacted earth.

The pond bottom shall be scarified, watered, mixed and compacted using medium to heavy vibratory compaction equipment and steel wheeled tandem rollers to be approved by the engineer. Pond bottom shall be compacted to at least 90% relative compaction. The completed bottom shall be smooth and free from sudden changes in grade. The finished surface shall not vary more than 0.15 foot from the established grade.

| | | |
|---|---|---|
| FMC<br>Phossy Water Project<br>Pocatello, Idaho | Clarifier & Surge Ponds<br>PVC [redacted] | Project No. 02-2092<br><br>January 18, 1979 |

Specification No. 5000-3

## REVISIONS

Each time a new page is added to this specification, or an existing page is revised, only this revisions page reissues with the new or revised pages.

| REV. | DATE | BY | PAGE | REMARKS |
|---|---|---|---|---|
| A | 1/18/79 | MS | All | Issued for Approval |

| FMC<br>Phossy Water Project<br>Pocatello, Idaho | Clarifier & Surge Ponds<br>[redacted] | Project No. 02-2092<br>January 18, 1979 |
|---|---|---|

Specification No. 5000-3

## 1.0 SCOPE

This specification covers the requirements for furnishing and installing a polyvinyl chloride (PVC) plastic bottom and embankment liner, and liner protection blanketing, for the new clarifier and surge ponds.

## 2.0 MATERIALS

### 2.1 PVC Materials

The materials furnished under these specifications shall be first quality products designed and manufactured for the purposes of this work and which have been satisfactorily demonstrated by prior use to be suitable and durable for such purposes.

The PVC lining shall consist of standard widths of calendered polyvinyl chloride sheeting, neutral gray to black in color, 30 mils in thickness, and fabricated into the minimum number of large pieces required to fit the facility. The sheeting shall be manufactured from domestic virgin polyvinyl chloride resin and specifically compounded for use in hydraulic facilities. Reprocessed material shall not be used. The PVC materials shall have the following physical characteristics:

| Test | Typical Test Values | Test Method |
|---|---|---|
| Thickness | ± 5% | ASTM-D1593 |
| Specific Gravity | 1.23 | ASTM-D792A |
| Tensile Strength, lbs/in width | 66 | ASTM-D882B |
| Elongation, % min. | 325 | ASTM-D882B |
| 100% Modulus, lbs/in | 30 | ASTM-D882B |
| Elmendorfer Tear, gms | 6000 | ASTM-D1922 |
| Graves Tear, lbs/min | 8.25 | ASTM-D1004 |
| Water Extraction, % max. | 0.15 | ASTM-D1239 |
| Volatility, % max. | 0.75 | ASTM-D1203A |
| Impact Cold Crack, °F | -20 | ASTM-1790 |
| Dimensional Stability, max. % (100°C - 15 minutes) | 5 | |
| Resistance to Burial | | Para. 4C (1) per |
| Tensile Strength Loss | 5.0 | Bur. of Reclamation |
| Elongation Loss | 20.0 | Procedure |

| FMC<br>Phossy Water Project<br>Pocatello, Idaho | Clarifier & Surge Ponds<br>PVC Lining | Project No. 02-2092<br><br>January 18, 1979 |
|---|---|---|

Specification No. 5000-3

## 3.0 FACTORY FABRICATION

Individual calendered widths of lining materials shall be fabricated into large sections by solvent bonding into a minimum number of pieces that can be readily handled, as required to fit the installation. Lap joints with a minimum width of 1/2 inch shall be used. Joints shall meet the seam strength of 80 percent of the specified sheet strength. After fabrication, the lining shall be accordion folded in both directions, and packaged for minimum handling in the field.

## 4.0 FIELD INSTALLATION

### 4.1 Preparation

The ponds to receive the lining shall be constructed by others, but shall be the responsibility of the lining contractor to inspect the finished surface and correct any irregularities and deformities which might adversely affect a satisfactory liner installation. All vegetation must be removed. A soil sterilant may be required at the discretion of the engineer.

### 4.2 Lining Application

The lining shall be installed in such a manner as to assure minimum handling. The lining shall be closely sealed around inlets and outlets as shown on the drawings. Any portion of lining damaged during installation, by any cause, shall be removed or repaired by using additional lining material bonded to the in-place liner with the appropriate adhesive (see Paragraph 4.3) according to the manufacturer's recommendations.

### 4.3 Field Joints

Lap joints shall be used to seal factory fabricated pieces of lining together in the field. Lap joints shall be formed by lapping the edges of pieces a minimum of 2 inches. The contact surfaces shall be wiped clean to remove all dirt, dust, moisture, or other foreign materials. Sufficient cold-applied vinyl-to-vinyl adhesive shall be applied to both contact surfaces in the joint area and the two surfaces shall be pressed together immediately. Any wrinkles shall be removed. Ratios of solvents to adhesives shall be in accordance with the manufacturer's recommendations for the lining materials being joined. Field made splices shall have a strength of 80 percent of the specified sheet strength.

Specification No. 5000-3

4.0 FIELD INSTALLATION - continued

4.4 Completion

All joints, on completion of the work, shall be tightly bonded. Any lining surface damaged due to scuffing, penetration by foreign objects, or distress from rough subgrade shall, as directed by the engineer, be replaced or covered and sealed with an additional layer of PVC of adequate size.

4.5 Liner Anchorage and Protection

4.5.1 Material - Liner protection covering shall consist of a 12 inch layer of earth cover topped by a 6 inch layer of crushed slag, as shown on the drawings.

The material obtained from the pond area excavation shall be suitable for the earth cover, provided all organic material, sticks, trash, and sharp rocks are first removed. No pieces larger than two (2) inches shall be placed within the bottom six (6) inches of this liner anchor material. No piece larger than four (4) inches shall be placed within the top six (6) inches of the anchor material. This material shall be reasonably even graded and free draining.

The crushed slag material shall be as specified in Specification 5000-2, Roadways and Surfaced Areas, for Aggregate Base Course, except that it shall conform to the following limits:

| Passing Sieve Size | Percent by Weight |
|---|---|
| 3-1/2 Inch | 90-100 |
| 2-1/2 Inch | 25- 60 |
| 1-1/2 Inch | 0- 15 |
| 3/4 Inch | 0- 5 |

4.5.2 Application

The liner anchor courses shall be distributed over the area required, as shown on the drawings. The depth shall be as required to provide a finish depth as shown on the drawings after being compacted using compaction equipment to be approved by the engineer. Grading equipment shall not be driven directly on the liner, except as directed by the engineer. The finished surface shall be smooth and true to the line and grade as indicated on the drawings.

| | | |
|---|---|---|
| FMC | Clarifier & Surge Ponds | Project No. 02-2092 |
| Phossy Water Project | Under Drain, Leak Detection | |
| Pocatello, Idaho | System & Appurtenances | January 18, 1979 |

Specification No. 5000-4

## REVISIONS

Each time a new page is added to this specification, or an existing page is revised, only this revisions page reissues with the new or revised pages.

| REV. | DATE | BY | PAGE | REMARKS |
|---|---|---|---|---|
| A | 1/18/79 | MS | All | Issued for Approval |

| FMC<br>Phossy Water Project<br>Pocatello, Idaho | Clarifier & Surge Ponds<br>[redacted] Drain, Leak Detection<br>System & Appurtenances | Project No. 02-2092<br><br>January 18, 1979 |
|---|---|---|

Specification No. 5000-4

## 1.0 GENERAL

This specification covers the material and installation requirements for the under drain and leak detection system and all other appurtenances for the clarifier pond and the surge pond.

Trenching and backfilling for underground piping, as well as fill and backfill material, are specified in other sections.

In addition to the specific specifications, standards and codes cited herein, all construction shall conform to the Uniform Building Code, 1976 Edition, and the latest edition of the Standards of the Occupational Safety and Health Administration (OSHA).

## 2.0 MATERIALS

### 2.1 Pipe

Pipe shall be plastic, corrugated, tubing (Advanced Drainage System (ADS) Tubing or approved equal), perforated or non-perforated as indicated on the plans. Pipe shall conform to ASTM 405.

### 2.2 Permeable Under Drain Material

Permeable material for backfilling around perforated under drain pipe shall consist of hard, durable, clean concrete sand, and shall be free from organic material, clay balls or other deleterious substances. The material shall conform to the following limits:

| Sieve Size | Percent Passing Sieve |
|---|---|
| 3/8" | 100 |
| No. 4 | 95-100 |
| No. 8 | 45- 85 |
| No. 50 | 10- 30 |
| No. 100 | 2- 10 |

### 2.3 Inspection Manholes

Inspection manholes shall be constructed of precast concrete rings with fabricated steel covers and ladders as shown on the drawings. Mortar joints between precast concrete rings shall be fully bedded in jointing compound and smoothed to a uniform surface on both the inside and the outside of the manhole.

| FMC | Clarifier & Surge Ponds | Project No. 02-2092 |
|---|---|---|
| Phossy Water Project | Under Drain, Leak Detection | |
| Pocatello, Idaho | System & Appurtenances | January 18, 1979 |

Specification No. 5000-4

## 3.0 TRENCHING, BEDDING, INSTALLATION AND BACKFILL

The subcontractor shall perform all excavation, trenching, and backfilling to satisfactorily install the under drain system as specified herein and as shown on the drawings. The subcontractor shall be responsible for the protection of tubing from deformation or floating, as well as the intrusion of material into the tubing, due to unstable trench walls or bottom.

The subcontractor shall examine the site and become familiar with the conditions to be expected prior to submitting his proposal.

The trench shall be excavated to a depth to provide for the envelope of under drain material. The under drain material shall be installed around the perforated tubing to provide for proper bedding support. If the trench is wider than shown on the drawings, the trench shall be filled on both sides with under drain material so there are no void spaces between the tubing and the walls of the trench.

The under drain material shall be placed carefully to form an even, firm bedding without disturbing the tubing grade and alignment. Mud, excavated material, or foreign matter shall not be permitted to mix with the under drain material during installation.

Excavation for observation manholes shall be made accurately to the lines, grades, and elevation shown on the plans. Foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of the structure foundation. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm surface. Loose disintegrated rock and thin strata shall be removed. When concrete is to be placed against an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until the concrete is to be placed.

Backfilling around the concrete or masonry structure shall not be started until the concrete or mortar has sufficiently hardened to prevent damage to the structure.

Fittings and couplings shall be installed according to manufacturer's instructions. Couplings shall be used at all joints and fittings, at all changes in direction, at junctions with another line and at the ends of lines. All fittings shall be compatible with the tubing.

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Poleline Road, Pocatello, Idaho 83201 (208) 237-5610

Date September 19, 1979

Client FMC Corporation
Phosphorous Chemicals Division
Pocatello, Idaho 83201

Project: FMC Ponds Project
Pocatello, Idaho 83201

Invoicing #13421

Job No PC 11563

## Particle-Size Gradation

Reference: ASTM C136, C117

| U. S. Stand. Sieve No. | Weight Retained | % Retained | % Passing | Spec. % Passing |
|---|---|---|---|---|
| 3/4" | | | 100 | |
| #4 | | | 100 | |
| 10 | | | 100 | |
| 40 | | | 99 | |
| 100 | | | 98 | |
| 200 | | | 94.1 | |

Weight original samples: _____

Tested by E.S.

Computed by E.S.

Checked by

CERTIFIED TEST COPY

AMERICAN TESTING LABORATORY, INC.
Michael R. Memmott, Sales Manager

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Pole Line Road, Pocatello, Idaho 83201 (208) 237-5610

Date: September 19, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project: FMC Ponds Project
Pocatello, Idaho

Invoicing #13421

Job No PC 11563

AASHTO T-180, Method A, Moisture-Density-Compaction Relationship for the FMC Ponds Project, Pocatello, Idaho.

PROCTOR RESULTS

Sample #1
Maximum Dry Density: 115.8 pcf
Optimal Moisture: 12.6%
Soil Description (U.S.C.): Light Brown Silt with some Caliche and trace Sand, (ML).

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Pebble Road, Pocatello, Idaho 83201 (208) 237-5610

Date: October 26, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project: Pond Dikes Project
Pocatello, Idaho
West of Pocatello

Invoicing #9461 Job No

AASHTO T-180, Method A, Moisture-Density-Compaction Relationship for the FMC Pond Dikes Project, West of Pocatello, Idaho.

PROCTOR RESULTS

Sample #2
Culvert Backfill Sample
Maximum Dry Density: 113.4 pcf
Optimal Moisture: 12.0%
Soil Description (U.S.C.): Silt with some fine Sands, (ML).

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

# AMERICAN TESTING LABORATORIES INC.

## JOB ENGINEER'S DAILY REPORT CONTROL OF COMPACTED FILL

Date: 10/3/79
Day of Week: Wednesday

| | | | |
|---|---|---|---|
| Job Location: West of Pocatello | Client or Owner: FMC Corporation | | |
| General Location of Fill | Purpose of Fill or Nature of Structure to be Supported: Pond Dikes | Job No.: PC 11563 | |
| General Contractor: Finlayson Const. | Grading or Earthwork Contractor: Tiger Asphalt | Job Engineer | HRS Charged |
| Contractor's Shift: Days | Contractor's Superintendent or Foreman: Larry | Assistants | HRS Charged |

Source and Description of Fill Material: Silt, some Caliche and some fine Sand, light Brown; on-site.

Weather: Warm and sunny

| Test Number | Test Location | Elevation | Reference Compaction Curve | Maximum Dry Density lbs./cu.ft. | Fill Moisture % | Test Dry Density lbs./cu.ft. | % of Maximum Dry Density | Daily Report Describing Compaction |
|---|---|---|---|---|---|---|---|---|
| 1. | Dike #2, Center | | | 115.8 | 10.0 | 105.0 | 90.7 | |
| 2. | Outer Dike, 9' below grade | | | 115.8 | 11.0 | 106.8 | 92.2 | |
| 3. | Dike #3, 5th lift | | | 115.8 | 12.0 | 109.8 | 94.8 | |
| 4. | Dike #3, 5th lift | | | 115.8 | 11.1 | 108.5 | 93.7 | |
| 5. | Dike #3, 5th lift | | | 115.8 | 10.6 | 104.5 | 90.2 | |
| 6. | Dike #3, 5th lift | | | 115.8 | 11.5 | 108.5 | 93.7 | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

SUPPLEMENTARY REPORT (Describe equipment used for hauling, spreading, watering, conditioning and compacting, also report thickness of lifts, and number of roller trips.)

Dike #2, 5th lift (continued): An additional 2 passes were made with a vibrating sheepsfoot. Water was also added to the lift. Test #1 indicates the moisture content is still too low for adequate compaction.

Outside Dike (continued): 8" of the inplace fill was scarfed in the problem area, and water was then added before the four passes were made with a vibrating sheepsfoot. Test #2 indicates compaction to be complete on this lift.

Dike #3, 5th lift: Two 6" shallow lifts were placed adding water between lifts. 4 passes were made on the outside of the dike, and 6 passes were made on the center of the dike using a vibrating sheepsfoot. The test results satisfy specifications.

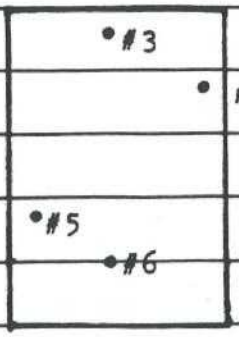
CONTINUED ON NEXT PAGE ☒

# AMERICAN TESTING LABORATORIES INC.

JOB ENGINEER'S DAILY REPORT CONTROL OF COMPACTED FILL

| Job. No. | |
|---|---|
| PC 11563 | |
| Page 2 of 2 | |
| Report Sequence No. | |
| Date | Day of Week |
| 10/3/79 | Wed. |
| Job Engineer | HRS Charged |
| Assistants | HRS Charged |

DIKE #3 TEST LOCATIONS




Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

# AMERICAN TESTING LABORATORIES INC.

## JOB ENGINEER'S DAILY REPORT CONTROL OF COMPACTED FILL

Date: 10/2/79
Day of Week: Tuesday

| | | | |
|---|---|---|---|
| Job Location: West of Pocatello | Client or Owner: FMC Corporation | | |
| General Location of Fill | Purpose of Fill or Nature of Structure to be Supported: Pond Dike | Job No.: PC 11563 | |
| General Contractor | Grading or Earthwork Contractor: Tiger Asphalt | Job Engineer | HRS Charged |
| Contractor's Shift: Days | Contractor's Superintendent or Foreman: Larry | Assistants | HRS Charged |

Source and Description of Fill Material: Silt, some Caliche and some fine Sand, light Brown; on-site

Weather: Warm, Sunny and Windy

| Test Number | Test Location | Elevation | Reference Compaction Curve | Maximum Dry Density lbs./cu.ft. | Fill Moisture % | Test Dry Density lbs./cu.ft. | % of Maximum Dry Density | Daily Report Describing Compaction |
|---|---|---|---|---|---|---|---|---|
| 1. | Dike #2* | 4th lift | | 115.8 | 13.9 | 111.0 | 95.8 | Accept |
| 2. | Dike #2* | 4th lift | | 115.8 | 12.6 | 105.3 | 90.8 | Accept |
| 3. | Dike #2* | 4th lift | | 115.8 | 14.8 | 111.5 | 96.3 | Accept |
| 4. | Outer Dike W. 6' below final grade | | | 115.8 | 12.5 | 106.3 | 91.8 | Accept |
| 5. | Outer Dike, 9' | below | grade | 115.8 | 13.5 | 101.8 | 87.8 | |
| 6. | Retest #5 | | | 115.8 | 13.0 | 100.0 | 86.4 | |
| 7. | Retest #6 | | | 115.8 | 10.5 | 102.7 | 88.7 | |
| 8. | Retest #7 | | | 115.8 | 10.8 | 102.0 | 88.1 | |
| 9. | Retest #8 | | | 115.8 | 12.7 | 104.7 | 90.4 | |

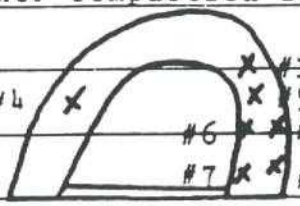
SUPPLEMENTARY REPORT (Describe equipment used for hauling, spreading, watering, conditioning and compacting, also report thickness of lifts, and number of roller trips.)

| | | | | | | |
|---|---|---|---|---|---|---|
| 10. | Retest #9 | | 115.8 | 12.6 | 104.3 | 90.1 |

*Dike #2, 4th lift (continued): The 4th lift was recompacted in 4 passes with a vibrating sheepsfoot. All tests meet the requirements for compaction of the dikes.

| | | |
|---|---|---|
| Location #3 | X | Dike #2 |
| Location #2 | X | North ↓ |
| Location #1 | X | |

Outside Dike: Four passes were completed on the West End of the Outside Dike using a vibrating sheepsfoot. Water was added before compaction. Tests indicate further compaction is required on the Northwest End.




CONTINUED ON NEXT PAGE ☒

# AMERICAN TESTING LABORATORIES INC.

## JOB ENGINEER'S DAILY REPORT CONTROL OF COMPACTED FILL

Date: 10/2/79
Day of Week: Tuesday

| | | | |
|---|---|---|---|
| Job Location: West of Pocatello | Client or Owner: FMC Corporation | | |
| General Location of Fill | Purpose of Fill or Nature of Structure to be Supported: Pond Dike | Job No.: PC 11563 | |
| General Contractor | Grading or Earthwork Contractor: Tiger Asphalt | Job Engineer | HRS Charged |
| Contractor's Shift: Days | Contractor's Superintendent or Foreman: Larry | Assistants | HRS Charged |

Source and Description of Fill Material: Silt, some Caliche and some fine Sand. light Brown; on-site

Weather: Warm, Sunny and Windy

| Test Number | Test Location | Elevation | Reference Compaction Curve | Maximum Dry Density lbs./cu.ft. | Fill Moisture % | Test Dry Density lbs./cu.ft. | % of Maximum Dry Density | Daily Report Describing Compaction |
|---|---|---|---|---|---|---|---|---|
| 11. | Dike #3 | 4th lift | | 115.8 | 11.9 | 105.0 | 90.7 | |
| 12. | Dike #3 | 4th lift | | 115.8 | 11.2 | 105.3 | 90.8 | |
| 13. | Dike #3 | 4th lift | | 115.8 | 12.7 | 114.0 | 98.4 | |
| 14. | Dike #3 | 4th lift | | 115.8 | 11.7 | 104.3 | 90.0 | |
| 15. | Dike #1 | 7th lift | | 115.8 | 11.2 | 107.5 | 92.8 | |
| 16. | Dike #1 | 7th lift | | 115.8 | 12.8 | 105.5 | 91.1 | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

SUPPLEMENTARY REPORT (Describe equipment used for hauling, spreading, watering, conditioning and compacting, also report thickness of lifts, and number of roller trips.)

Dike #3; 4th lift: Two shallow, 6" lifts were placed, mixing water between lifts. The lift was then compacted with 3 passes using a vibrating sheepsfoot and 1 pass which was wheel rolled. Test results indicate further compaction necessary on the center of the North End of the dike.

Dike #1; 7th lift: The 7th lift was placed in the same manner as the 3rd lift, dike #3. Tests results indicate further compaction is necessary on the center of the dike.

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

CONTINUED ON NEXT PAGE ☐

# AMERICAN TESTING LABORATORIES INC.

## JOB ENGINEER'S DAILY REPORT CONTROL OF COMPACTED FILL

Date: 10/2/79
Day of Week: Tuesday

| | | | |
|---|---|---|---|
| Job Location: West of Pocatello | Client or Owner: FMC Corporation | | |
| General Location of Fill | Purpose of Fill or Nature of Structure to be Supported: Pond Dike | Job No.: PC 11563 | |
| General Contractor | Grading or Earthwork Contractor: Tiger Asphalt | Job Engineer | HRS Charged |
| Contractor's Shift: Days | Contractor's Superintendent or Foreman: Larry | Assistants | HRS Charged |

Source and Description of Fill Material: Silt, some Caliche and some fine Sands, light Brown; On-site.

Weather: Warm and sunny

| Test Number | Test Location | Elevation | Reference Compaction Curve | Maximum Dry Density lbs./cu.ft. | Fill Moisture % | Test Dry Density lbs./cu.ft. | % of Maximum Dry Density | Daily Report Describing Compaction |
|---|---|---|---|---|---|---|---|---|
| 1. | Dike #2 Center | 4" below | | | | | | |
| | surface, 4th lift | | | 115.8 | 11.2 | 104.75 | 90.4 | |
| 2. | Dike #2 Center | 6" below | | | | | | |
| | surface, 4th lift | | | 115.8 | 14.3 | 105.0 | 90.7 | |
| 3. | Dike #1 North End, 6th lift | | | 115.8 | 13.5 | 98.25 | 84.8 | w/o vibrating fo |
| 4. | Dike #1 North End, 2' East | | | | | | | w/vibrating foot |
| | of #3, 6th lift | | | 115.8 | 12.2 | 104.25 | 90.2 | |
| 5. | Outside Dike, South Side | | | | | | | |
| | 9' below final grade | | | 115.8 | 12.3 | 102.0 | 88.1 | |
| | | | | | | | | |

SUPPLEMENTARY REPORT (Describe equipment used for hauling, spreading, watering, conditioning and compacting, also report thickness of lifts, and number of roller trips.)

Dike #2; 4th lift: Compaction was obtained with a combination of the vibrating sheepsfoot and a 25 yard scraper filled to capacity. Tests indicate moisture to be a little on the low side on the surface. Further compaction is required.

Dike #3; 6th lift (continued): Further compaction on the 6th lift was attempted with 6 passes using a vibrating sheepsfoot on one-half of the lift and a non-vibrating sheepsfoot on the other half of the lift. Tests #3 and #4 indicate that the vibrating method maintained higher compaction results than the non-vibrating method. The overall results indicate that both efforts are at least 2% lower than the previous compaction results.

CONTINUED ON NEXT PAGE XX

# AMERICAN TESTING LABORATORIES INC.

JOB ENGINEER'S DAILY REPORT CONTROL OF COMPACTED FILL

| Job. No. | |
|---|---|
| PC 11563 | |
| Page 2 of 2 | |
| Report Sequence No. | |
| Date | Day of Week |
| Job Engineer | HRS Charged |
| Assistants | HRS Charged |

Outside Dike: The lift was watered by truck and an additional 6 passes were made by a vibrating sheepsfoot. Test #5 indicates a 2 to 5% increase in compaction over previous test results. Further compaction will be attempted.

NOTE: A meeting was held and the decision was made to change the 90-95% compaction requirements to 90-92% compaction. The 3rd lift on the #3 dike and the 6th lift on the #1 dike were accepted under the new standard.

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

# AMERICAN TESTING LABORATORIES INC.

## JOB ENGINEER'S DAILY REPORT CONTROL OF COMPACTED FILL

Date: 10/1/79
Day of Week: Monday

| | | | |
|---|---|---|---|
| Job Location: West of Pocatello | Client or Owner: FMC Corporation | | |
| General Location of Fill | Purpose of Fill or Nature of Structure to be Supported: Pond Dike | Job No. | |
| General Contractor: Finlayson Const. | Grading or Earthwork Contractor: Tiger Asphalt | Job Engineer | HRS Charged |
| Contractor's Shift: Days | Contractor's Superintendent or Foreman: Larry | Assistants | HRS Charged |

Source and Description of Fill Material: Silt some caliche and some fine sands; light Brown, on-site

Weather: warm and sunny

| Test Number | Test Location | Elevation | Reference Compaction Curve | Maximum Dry Density lbs./cu.ft. | Fill Moisture % | Test Dry Density lbs./cu.ft. | % of Maximum Dry Density | Daily Report Describing Compaction |
|---|---|---|---|---|---|---|---|---|
| 1. | #1 Dike Center | 5th lift | | 115.8 | 13.2 | 107.25 | 92.6 | |
| 2. | #1 Dike Retest | 5th lift | | 115.8 | 14.2 | 106.8 | 92.2 | |
| 3. | #1 Dike Retest | 5th lift | | 115.8 | 17.3 | 108.25 | 93.5 | |
| 4. | #3 Dike Center | 3rd lift | | 115.8 | 12.5 | 108.0 | 93.3 | |
| 5. | #3 Dike Center | 3rd lift | | 115.8 | 11.3 | 104.25 | 90.0 | |
| 6. | #1 Dike Retest | 5th lift | | 115.8 | 14.1 | 110.4 | 95.3 | |
| 7. | West End Outside Dike | | | | | | | |
| | 10' below the top of | | Dike | 115.8 | 13.8 | 105.4 | 91.0 | |
| 8. | #3 Dike Retest | 3rd lift | | 115.8 | 12.9 | 108.0 | 93.3 | |
| 9. | #3 Dike Retest | 3rd lift | | 115.8 | 12.3 | 107.7 | 93.0 | |

SUPPLEMENTARY REPORT (Describe equipment used for hauling, spreading, watering, conditioning and compacting; also report thickness of lifts, and number of roller trips.)

#1 Dike: Arrived at the jobsite at 8"20 A.M. and tested 5th lift on Dike #1 (far west dike). An additional 12 passes were made with a 25 yard scraper filled to capacity on center of dike #1. The first 4" were then scraped off for testing (see tests #2 and #3). Sheep's foot was used on 3 additional passes on dike #1. Retest #6 shows 95.3% compaction, thus, 6th lift was placed.

#3 Dike: Third dike reports show 3rd lift actual height was about 15"*. Tests 4 and 5 were taken showing additional compaction necessary.

West End of Outer Dike: Test #7 shows compaction meeting the specifications of 90%. The number of lifts was not known, but a test was taken approximately 10' below the top of the outside dike.

*The first three lifts consisted of only 6".

CONTINUED ON NEXT PAGE

# AMERICAN TESTING LABORATORIES INC.

JOB ENGINEER'S DAILY REPORT CONTROL OF COMPACTED FILL

| | |
|---|---|
| Job. No. | |
| Page 2 of 2 | |
| Report Sequence No. | |
| Date | Day of Week |
| 10/1/79 | Monday |
| Job Engineer | HRS Charged |
| Assistants | HRS Charged |

#3 Dike; 3rd lift (continued): Several passes were made on the 3rd lift with the sheep's-foot. The top 4" was removed by the scraper for testing. Water was also added before additional compaction. Tests #8 and #9 show the moisture content of the fill to be below optimal. There was very little change in percent compaction. The contractor was to water the fill before further compaction.

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Pole Line Road, Pocatello, Idaho 83201 (208) 237-5610

Date: October 1, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project: FMC Ponds Improvements
West of Pocatello, Idaho

Invoicing #13456 Job No.

Nuclear Relative Compaction Test Data for the FMC Ponds Improvements, West of Pocatello, Idaho.

All tests taken on subbase fill material.

| OCATION | MAX. WEIGHT LBS./CU. FT. | FIELD WEIGHT LBS./CU. FT. | %MOISTURE | %COMPACTIC |
|---|---|---|---|---|
| . #1 Dike, 5th lift | 115.8 | 104.3 | 14.6 | 90.0 |
| . Retest #1 | 115.8 | 101.8 | 21.9 | 87.9 |
| . Retest #2 | 115.8 | 104.0 | 18.3 | 89.8 |
| . #2 Dike, 3rd lift | 115.8 | 108.8 | 14.9 | 93.9 |
| . Retest #4 | 115.8 | 109.0 | 14.2 | 94.1 |
| . Retest #1 | 115.8 | 107.3 | 12.8 | 92.6 |
| . Retest #6 | 115.8 | 107.0 | 13.1 | 92.4 |
| . Retest #6 | 115.8 | 111.5 | 14.8 | 96.3 |
| F NOON TESTS | | | | |
| 3 Dike, 1st lift | 115.8 | 105.5 | 11.4 | 91.1 |
| . Retest #1 | 115.8 | 106.8 | 11.9 | 92.2 |
| . Far Northwest Bank | 115.8 | 94.3 | 16.7 | 81.4 |
| . Retest #3 | 115.8 | 103.5 | 12.1 | 89.4 |
| . Pump House Foundation | 115.8 | 108.5 | 14.7 | 93.7 |
| . Retest #3 (-4") | 115.8 | 104.0 | 13.5 | 89.8 |
| . #3 Dike, 3rd lift | 115.8 | 107.3 | 12.8 | 92.6 |
| . Dike #1 | 115.8 | 106.5 | 11.7 | 92.0 |
| . Retest #8 | 115.8 | 104.8 | 13.6 | 90.4 |
| O. Dike #2 | 115.8 | 109.0 | 12.8 | 94.1 |

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

# AMERICAN TESTING LABORATORIES INC.

## JOB ENGINEER'S DAILY REPORT CONTROL OF COMPACTED FILL

Date: 10/1/79
Day of Week: Monday

| | | | |
|---|---|---|---|
| Job Location: West of Pocatello | Client or Owner: FMC Corporation | | |
| General Location of Fill | Purpose of Fill or Nature of Structure to be Supported: Ponds Dikes | Job No.: PC 11563 | |
| General Contractor | Grading or Earthwork Contractor: Tiger Asphalt | Job Engineer | HRS Charged |
| Contractor's Shift: Days | Contractor's Superintendent or Foremen: Larry | Assistants | HRS Charged |

Source and Description of Fill Material: Silt with some caliche and some fine Sands, light Brown, on-site.

Weather: warm and sunny

| Test Number | Test Location | Elevation | Reference Compaction Curve | Maximum Dry Density lbs./cu.ft. | Fill Moisture % | Test Dry Density lbs./cu.ft. | % of Maximum Dry Density | Daily Report Describing Compaction |
|---|---|---|---|---|---|---|---|---|
| 1. | #1 Dike Center | 6th lift | | 115.8 | 14.4 | 104.0 | 89.8 | |
| 2. | #3 Dike Center | 3rd lift | | 115.8 | 11.8 | 109.5 | 94.5 | |
| 3. | #3 Dike N. End | 3rd lift | | 115.8 | 13.1 | 107.0 | 92.4 | |
| 4. | #3 Dike S. End | 3rd lift | | 115.8 | 16.4 | 106.5 | 91.9 | |
| 5. | #1 Dike Retest | 6th lift | | 115.8 | 16.7 | 107.5 | 92.8 | |
| 6. | #1 Dike Retest | 6th lift | | 115.8 | 13.5 | 107.5 | 92.8 | |
| 7. | Northwest Corner; Outside* | | | 115.8 | 11.5 | 100.0 | 86.4 | |
| 8. | Northwest Corner; Outside | | | | | | | |
| | Dike Retest* | | | 115.8 | 12.7 | 96.25 | 83.1 | |

*See supplementary report

SUPPLEMENTARY REPORT (Describe equipment used for hauling, spreading, watering, conditioning and compacting, also report thickness of lifts, and number of roller trips.)

#1 Dike, 6th lift: Two 6" shallow lifts were placed on the 5th layer, adding water between each lift. The lift was then compacted by a 25 yard scraper filled to capacity and a vibrating sheepsfoot. The test location was prepared by removing the first 4" of fill with the 25 yard scraper. One test was taken (test #1) indicating further compaction was necessary. Equipment used for additional compaction was a 25 yard scraper.

#3 Dike, 3rd lift: Water was added to the 3rd lift before compaction continued. A 25 yard scraper was used to compact the fill. Tests #2, 3, and 4 indicate compaction on the center of the dike near the 95% requirement. The south and north ends were approximately 2.0% lower than the center of the dike. Because of the difference in percent compaction, I suggested that the

CONTINUED ON NEXT PAGE **

# AMERICAN TESTING LABORATORIES INC.

JOB ENGINEER'S DAILY REPORT CONTROL OF COMPACTED FILL

| | |
|---|---|
| Job. No. | PC 11563 |
| Page | 2 of 2 |
| Report Sequence No. | |
| Date | Day of Week |
| Job Engineer | HRS Charged |
| Assistants | HRS Charged |

contractor obtain passing test results from at least 3 locations on dikes before adding any additional lifts. Recompaction on the 3rd dike will begin on the morning of October 2, 1979.

#1 Dike 6th lift (continued): #5 and #6 tests show an increase of 3%. Further compaction will continue on the morning of October 2, 1979.

Outside Dike; New lift: Tests #7 and #8 on the North west corner of the outside dike indicate that the moisture content is too low for effective compaction.

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Pocatello Road, Pocatello, Idaho 83201 (208) 237-5610

Date: September 28, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project: FMC Pond Improvements
West of Pocatello, Idaho

Invoicing #13448 Job No.

Nuclear Relative Compaction Test Data for the FMC Pond Improvements Project, West of Pocatello, Idaho.

MORNING TESTS

| OCATION | MAX. WEIGHT LBS./CU. FT. | FIELD WEIGHT LBS./CU. FT. | %MOISTURE | %COMPAC |
|---|---|---|---|---|
| . Dike #1; 4th lift | 115.8 | 107.8 | 14.6 | 93.0 |
| . Dike #2; 2nd lift | 115.8 | 102.8 | 15.3 | 88.7 |
| . Retest #2 (-4"); 2nd lift | 115.8 | 101.8 | 16.4 | 87.9 |
| . Dike #1 after scraping; 4th lift | 115.8 | 109.0 | 14.7 | 94.1 |
| . Retest #4 (-4"); 4th lift | 115.8 | 107.5 | 13.0 | 92.8 |
| . Dike #2 after rerolling; 2nd lift | 115.8 | 102.8 | 17.8 | 88.7 |

The contractor continued placement of water and compaction of the fill material. An additional sheeps foot was delivered to the job site to help compact the soils.

AFTERNOON TESTS

| | | | | |
|---|---|---|---|---|
| . Far Northwest Corner Bank; 2nd lift | 115.8 | 108.0 | 15.7 | 93.3 |
| . Center #1 Dike; 5th lift | 115.8 | 104.3 | 13.2 | 90.0 |
| . Pump house; 20' deep | 115.8 | 107.8 | 14.0 | 93.0 |
| . #2 Dike; 3rd lift | 115.8 | 108.0 | 13.0 | 93.3 |
| . Retest #4; 3rd lift | 115.8 | 100.0 | 14.0 | 86.3 |

Further compaction is required.

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Pocatello Road, Pocatello, Idaho 83201 (208) 237-5610

Date: September 26, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project: FMC Ponds Improvements
Pocatello, Idaho

Invoicing #13446 Job No.

Nuclear Relative Compaction Test Data for the FMC Ponds Project, Pocatello, Idaho.

All tests taken at second lift. Dike numbers go from West to East.

| LOCATION | MAX. WEIGHT LBS./CU. FT. | FIELD WEIGHT LBS./CU. FT. | %MOISTURE | %COMPACTIC |
|---|---|---|---|---|
| 1. Center West Dike #1 | 115.8 | 97.0 | 12.4 | 85.8 |
| 2. Center West Dike #2 | 115.8 | 103.5 | 13.0 | 89.4 |
| 3. Retest #2 | 115.8 | 99.0 | 14.1 | 85.5 |
| 4. Retest #3 after scraping | 115.8 | 104.8 | 13.6 | 90.4 |
| 5. Far Northwest Corner Bank | 115.8 | 102.0 | 16.7 | 88.1 |
| 6. Center of #1 Dike after recompacting | 115.8 | 100.5 | 11.4 | 86.8 |
| 7. Retest #6 | 115.8 | 100.0 | 12.0 | 86.3 |
| Center #2 Dike after recompacting | 115.8 | 103.5 | 12.1 | 89.4 |
| Testing uncompacted dry soft spots for comparison | 115.8 | 95.0 | 12.1 | 82.0 |
| 10. Testing uncompacted wet spot for comparison | 115.8 | 98.0 | 12.7 | 84.6 |

Contractor was advised to compact further.

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Pole Line Road, Pocatello, Idaho 83201 (208) 237-5610

Date: September 26, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project: FMC Ponds Improvements
West of Pocatello

Invoicing #13446

Job No:

Nuclear Relative Compaction Test Data for the FMC Ponds Improvements Project, West of Pocatello, Idaho.

| OCATION | MAX. WEIGHT LBS./CU. FT. | FIELD WEIGHT LBS./CU. FT. | %MOISTURE | %COMPACTIC |
|---|---|---|---|---|
| . Center of #1 Dike | 115.8 | 102.5 | 12.7 | 88.5 |
| . Retest #1; 22 passes | 115.8 | 104.8 | 14.1 | 90.5 |
| . Retest #2; 42 passes | 115.8 | 109.8 | 14.8 | 94.8 |
| . 150' South of Test #3 | 115.8 | 104.3 | 13.2 | 90.0 |
| . Retest #4 after scraping Third Lift Afternoon Tests) | 115.8 | 107.5 | 13.9 | 92.8 |

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

RM:mn

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Poleline Road, Pocatello, Idaho 83201 (208) 237-3610

Date: September 25, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project: Ponds Improvements Project
Pocatello, Idaho

Invoicing #13437

Job No: PC 11563

Nuclear Relative Compaction Test Data for the Ponds Improvements Project, West of Pocatello, Idaho.

All tests taken on the initial scarified subgrade material after an additional 6.0" lift was placed and compacted.

| OCATION | MAX. WEIGHT LBS./CU. FT. | FIELD WEIGHT LBS./CU. FT. | %MOISTURE | %COMPACTIC |
|---|---|---|---|---|
| . Center West Dike | 115.8 | 112.7 | 14.0 | 97.3 |
| . 100' South of location #1 | 115.8 | 108.5 | 16.1 | 93.7 |
| . 100' North of location #1 | 115.8 | 109.3 | 13.9 | 94.4 |

This reconciles low test results with observed adequate compaction.

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Poleline Road, Pocatello, Idaho 83201 (208) 237-8610

Date: September 25, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project: Ponds Project
Pocatello, Idaho

Invoicing #13441

Job No:

Nuclear Relative Compaction Test Data for the FMC Ponds Improvements Project, West of Pocatello, Idaho.

All tests taken on Far West Dike

| LOCATION | MAX. WEIGHT LBS./CU. FT. | FIELD WEIGHT LBS./CU. FT. | %MOISTURE | %COMPACTION |
|---|---|---|---|---|
| . 235' North from Center of South Dike; East Side of Crest. | 115.8 | 100.0 | 12.0 | 86.3 |
| . 235' North from Center of South Dike; West Side of Crest. | 115.8 | 103.5 | 13.0 | 89.4 |
| . 235' North from Center of South Dike; Center of Crest. | 115.8 | 98.75 | 14.4 | 85.3 |
| . 255' North from Center of South Dike; East Side of Crest. | 115.8 | 102.75 | 14.8 | 88.7 |
| . 255' North from Center of South Dike; West Side of Crest. | 115.8 | 96.75 | 13.7 | 83.5 |
| . 260' North from Center of South Dike; Center of Crest. | 115.8 | 97.7 | 13.1 | 84.4 |
| . 182' North from Center of South Dike; Center of Crest. | 115.8 | 101.1 | 13.1 | 87.3 |
| . 260' North from Center of South Dike; Center of Crest. | 115.8 | 100.7 | 14.2 | 87.0 |
| . 260' North from Center of South Dike; East from Center of Crest. | 115.8 | 102.0 | 12.7 | 88.1 |

Contractor was advised to recompact after tests #1 and #2.
(Report Continued on Page 2)

(Continued from page 1)

| LATION | MAX. WEIGHT LBS./CU. FT. | FIELD WEIGHT LBS./CU. FT. | %MOISTURE | %COMPACTIO |
|---|---|---|---|---|
| 0. Retest of Location #9 after further compaction. | 115.8 | 103.5 | 16.9 | 89.4 |
| 1. Retest of location #9 and #10 after further compaction. | 115.8 | 110.8 | 12.8 | 95.6 |
| 2. 280' North from Center of South Dike; Center of Crest. | 115.8 | 109.4 | 12.4 | 94.5 |

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Pebble Road, Pocatello, Idaho 83201 (208) 237-5610

Date: September 24, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project: FMC Ponds Project
Pocatello, Idaho

Invoicing #13431

Job No: PC 11563

Nuclear Relative Compaction Test Data for the FMC Ponds Project, West of Pocatello, Idaho.

All tests taken on the initial lift of scarified and recompacted subgrade soils.

| LOCATION | MAX. WEIGHT LBS./CU. FT. | FIELD WEIGHT LBS./CU. FT. | %MOISTURE | %COMPACT |
|---|---|---|---|---|
| . Center, Far West Dyke | 115.8 | 91.5 | 14.7 | 79.0 |
| . South of Center, Far West Dyke | 115.8 | 96.8 | 12.4 | 83.6 |
| . North of Center, Far West Dyke | 115.8 | 96.0 | 10.9 | 82.9 |
| . Extreme South Side of Far West Dyke | 115.8 | 94.8 | 14.0 | 81.8 |
| . Retest of Location #2 after further compaction | 115.8 | 91.8 | 13.9 | 79.2 |
| Retest of Location #2 and #5 after further compaction | 115.8 | 93.0 | 12.6 | 80.3 |

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Pebble Road, Pocatello, Idaho 83201 (208) 237-8610

Date: September 24, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project: FMC Ponds Project
Pocatello, Idaho

Invoicing #13434

Job No. PC 11563

Nuclear Relative Compaction Test Data for the Ponds' Improvements Project, West of Pocatello, Idaho.

All tests taken on the initial scarified lift of subgrade materials on the far west dike.

| OCATION | MAX. WEIGHT LBS./CU. FT. | FIELD WEIGHT LBS./CU. FT. | %MOISTURE | %COMPACTION |
|---|---|---|---|---|
| . North End | 115.8 | 95.3 | 14.4 | 82.2 |
| . North of Center | 115.8 | 104.0 | 10.6 | 90.0 |
| . Center | 115.8 | 106.3 | 11.5 | 91.7 |
| . Retest of location #1 | 115.8 | 96.3 | 14.3 | 83.1 |
| . Retest of location #1 | 115.8 | 89.8 | 14.8 | 77.5 |
| . Center, retest of location #1 after re-compacting | 115.8 | 102.3 | 15.4 | 88.3 |
| :test of location #6 | 115.8 | 104.3 | 13.7 | 90.0 |

Further compaction was advised. The material has been observed to be adequately compacted.

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Pocatello Road, Pocatello, Idaho 83201 (208) 237-5610

Date September 19, 1979

Client FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project FMC Ponds Project
Pocatello, Idaho

Invoicing #13422

Job No PC 11563

Nuclear Relative Compaction Test Data for the FMC Ponds Project, Pocatello, Idaho.

All tests taken below the subbase fill.

| LOCATION | MAX. WEIGHT LBS./CU. FT. | FIELD WEIGHT LBS./CU. FT. | %MOISTURE | %COMPACTIC |
|---|---|---|---|---|
| 1. Center Far West Dike | 115.8 | 92.5 | 9.2 | 79.8 |
| 2. South Side of Far West dike | 115.8 | 89.5 | 11.2 | 77.3 |
| 3. North Side of Far West Dike | 115.8 | 97.8 | 11.5 | 84.4 |

All tests were taken before area was compacted. Contractor was advised to compact.

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Pocatello Road, Pocatello, Idaho 83201 (208) 237-5610

Date: September 19, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Pocatello, Idaho 83201

Project: FMC Ponds Project
Pocatello, Idaho 83201

Invoicing #13421

Job No PC 11563

## Particle-Size Gradation

Reference: ASTM C136, C117

| U. S. Stand. Sieve No. | Weight Retained | % Retained | % Passing | Spec. % Passing |
|---|---|---|---|---|
| 3/4" | | | 100 | |
| #4 | | | 100 | |
| 10 | | | 100 | |
| 40 | | | 99 | |
| 100 | | | 98 | |
| 200 | | | 94.1 | |

Weight original samples: _____

Tested by: E.S. Computed by: E.S. Checked by:

CERTIFIED TEST COPY

AMERICAN TESTING LABORATORY, INC.
Michael R. Memmott, Sales Manager

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Pololino Road, Pocatello, Idaho 83201 (208) 237-8610

Date: September 19, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project: FMC Ponds Project
Pocatello, Idaho

Invoicing #13421

Job No: PC 11563

AASHTO T-180, Method A, Moisture-Density-Compaction Relationship for the FMC Ponds Project, Pocatello, Idaho.

PROCTOR RESULTS

Sample #1
Maximum Dry Density: 115.8 pcf
Optimal Moisture: 12.6%
Soil Description (U.S.C.): Light Brown Silt with some Caliche and trace Sand, (ML).

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

AMERICAN TESTING LABORATORIES INC.
A Materials Testing and Construction Inspection Agency
3304 Poleline Road, Pocatello, Idaho 83201 (208) 237-5610

Date: October 26, 1979

Client: FMC Corporation
Phosphorous Chemicals Division
Box 4111
Pocatello, Idaho 83201

Project: Pond Dikes Project
Pocatello, Idaho
West of Pocatello

Invoicing #9461 Job No.

AASHTO T-180, Method A, Moisture-Density-Compaction Relationship for the FMC Pond Dikes Project, West of Pocatello, Idaho.

PROCTOR RESULTS

Sample #2
Culvert Backfill Sample
Maximum Dry Density: 113.4 pcf
Optimal Moisture: 12.0%
Soil Description (U.S.C.): Silt with some fine Sands, (ML).

Respectfully submitted,

AMERICAN TESTING LABORATORIES, INC.

Michael R. Memmott
Sales Manager

MRM:mn

# Appendix D-4

## Precipitator Slurry Drying Surface Impoundment (9E)

FMC
Air Drying Precipitator
Slurry
Pocatello, Idaho

Slurry Drying Pond
30 MIL PVC Lining

Project No. C84-06

Specification for Pond Liner

## REVISIONS

Each time a new page is added to this specification, or an existing page is revised, only this revisions page reissues with the new or revised pages.

| REV. | DATE | BY | PAGE | REMARKS |
|---|---|---|---|---|
| A | 1/18/79 | MS | All | Issued for Approval |
| O | 6/04/79 | MS | All | Issued for Construction |
| 1 | 7/16/81 | RPR | All | Reissued for Constructi |
| 2 | 6/19/84 | PSG | All | Issued for Construction (C84-06) |

## Specification for Pond Liner

### 1.0 SCOPE

This specification covers the requirements for furnishing and installing a polyvinyl chloride (PVC) plastic bottom and embankment liner, and liner protection blanketing, for the Slurry Drying Pond.

### 2.0 MATERIALS

#### 2.1 PVC Materials

The materials furnished under these specifications shall be first quality products designed and manufactured for the purposes of this work and which have been satisfactorily demonstrated by prior use to be suitable and durable for such purposes.

The PVC lining shall consist of standard widths of calendered polyvinyl chloride sheeting, neutral gray to black in color, 30 mils in thickness, and fabricated into the minimum number of large pieces required to fit the facility. The sheeting shall be manufactured from domestic virgin polyvinyl chloride resin and specifically compounded for use in hydraulic facilities. Reprocessed material shall not be used. The PVC materials shall have the following physical characteristics:

| Test | Typical Test Values | Test Method |
|---|---|---|
| Thickness | ± 5% | ASTM-D1593 |
| Specific Gravity | 1.23 | ASTM-D792A |
| Tensile Strength, lbs/in width | 66 | ASTM-D882B |
| Elongation, % min. | 325 | ASTM-D882B |
| 100% Modulus, lbs/in | 30 | ASTM-D882B |
| Elmendorfer Tear, gms | 6000 | ASTM-D1922 |
| Graves Tear, lbs/min | 8.25 | ASTM-D1004 |
| Water Extraction, % max. | 0.15 | ASTM-D1239 |
| Volatility, % max. | 0.75 | ASTM-D1203A |
| Impact Cold Crack, °F | -20 | ASTM-1790 |
| Dimensional Stability, max. % (100°C - 15 minutes) | 5 | |
| Resistance to Burial | | Para. 4C (1) per |
| Tensile Strength Loss | 5.0 | Bur. of Reclamatic |
| Elongation Loss | 20.0 | Procedure |

Specifications for Pond Liner

## 3.0 FACTORY FABRICATION

Individual calendered widths of lining materials shall be fabricated into large sections by solvent bonding into a minimum number of pieces that can be readily handled, as required to fit the installation. Lap joints with a minimum width of 1/2 inch shall be used. Joints shall meet the seam strength of 80 percent of the specified sheet strength. After fabrication, the lining shall be accordion folded in both directions, and packaged for minimum handling in the field.

## 4.0 FIELD INSTALLATION

### 4.1 Preparation

The ponds to receive the lining shall be constructed by others, but shall be the responsibility of the lining contractor to inspect the finished surface and correct any irregularities and deformities which might adversely affect a satisfactory liner installation. All vegetation must be removed. A soil sterilant may be required at the discretion of the engineer.

### 4.2 Lining Application

The lining shall be installed in such a manner as to assure minimum handling. The lining shall be closely sealed around inlets and outlets as shown on the drawings. Any portion of lining damaged during installation, by any cause, shall be removed or repaired by using additional lining material bonded to the in-place liner with the appropriate adhesive (see Paragraph 4.3) according to the manufacturer's recommendations.

### 4.3 Field Joints

Lap joints shall be used to seal factory fabricated pieces of lining together in the field. Lap joints shall be formed by lapping the edges of pieces a minimum of 2 inches. The contact surfaces shall be wiped clean to remove all dirt, dust, moisture, or other foreign materials. Sufficient cold-applied vinyl-to-vinyl adhesive shall be applied to both contact surfaces in the joint area and the two surfaces shall be pressed together immediately. Any wrinkles shall be removed. Ratios of solvents to adhesives shall be in accordance with the manufacturer's recommendations for the lining materials being joined. Field made splices shall have a strength of 80 percent of the specified sheet strength.

The BFGoodrich Company
Engineered Products Group
Oak Grove
P. O. Box 657
Marietta, Ohio 45750
373-6611

January 8, 1986

# LABORATORY TEST REPORT
## 30 MIL VINYL SHEET

| Physical Properties | | Requirement | Test Method | Test Results |
|---|---|---|---|---|
| Specific Gravity | | 1.22-1.30 | BFG Method | 1.26 |
| Thickness (Inches) | | ±5% | ASTM D1593 | .0300 |
| Tensile (psi, Min.) | M | 2400 | ASTM D882 | 2940 |
| | T | 2400 | | 2770 |
| Elongation (%, Min,) | M | 400 | ASTM D882 | 475 |
| | T | 400 | | 510 |
| 100% Modulus (psi, Range) | M | 1000-1600 | ASTM D882 | 1290 |
| | T | 1000-1600 | | 1155 |
| Elmendorf Tear (Grams/Mil, Min.) | M | 200 | ASTM 689-44T | 200+ |
| | T | 200 | | 200+ |
| Graves Tear (Lbs./In., Min.) | M | 320 | ASTM D1004-49T | 382 |
| | T | 320 | | 353 |
| Water Extraction (%, Max.) | | 0.30 | ASTM D1239 | +0.17 |
| Volatility (%, Max.) | | 0.7 | ASTM D1203-55T | 0.69 |
| Impact Cold Crack (°F Min.) | | -20 | ASTM D1790 | Material Passes |
| Dimensional Stability (% Max.) | M | 5 | ASTM D1204 | -2.4 |
| | T | 5 | 100°C/15 Min. | +1.4 |
| Shore Durometer "A" (Range) | | 93 ±3 | ASTM D676 | 93 |
| Outdoor Exposure (Sun Hours) | | 1500 | ) | Formulation used previously tested satisfactorily |
| Resistance to Burial | | Pass USBR | ) - | |
| Alkali Resistance | | Pass CRD-572-61 | ) | |
| Pinholes/10 Sq.Yd. (Max.) | | 1 | | OK |

Spec Number : 64-03-3730-92-3
Compound Number: 23-677
Production Date: November 6, 1985
Roll Numbers : 341397 representing
341395 through 341440

BFGoodrich Company
Industrial Products Division

Thomas R. Ward

Thomas R. Ward
Technical Manager

TRW:mbf

The BFGoodrich Company
P. O. Box 657
Marietta, Ohio 45750

August 1, 1986

# LABORATORY TEST REPORT
## 30 MIL VINYL SHEET

| Physical Properties | | Requirement | Test Method | Test Results |
|---|---|---|---|---|
| Specific Gravity | | 1.24-1.30 | BFG Method | 1.26 |
| Thickness (Inches) | | ±5% | ASTM D1593 | .0307 |
| Tensile (psi, Min.) | M | 2400 | ASTM D882 | 2800 |
| | T | 2400 | | 2645 |
| Elongation (%, Min.) | M | 400 | ASTM D882 | 520 |
| | T | 400 | | 550 |
| 100% Modulus (psi, Range) | M | 1000-1600 | ASTM D882 | 1255 |
| | T | 1000-1600 | | 1180 |
| Graves Tear | M | 320 | ASTM D1004-49T | 361 |
| (Lbs./In., Min.) | F | 320 | | 385 |
| Water Extraction (%, Max.) | | 0.35 | ASTM D1239 | +0.25 |
| olatility (%, Max.) | | 0.70 | ASTM D1203-55T | 0.57 |
| Impact Cold Crack (°F, Max.) | | -20 | ASTM D1790 | Material Passes |
| Dimensional Stability | M | 5 | ASTM D1204 | -2.6 |
| (%, Max.) | T | 5 | 100°C/15 Min. | +0.9 |
| Shore Durometer "A" (Range) | | 93 ±3 | ASTM D676 | 91 |
| Outdoor Exposure (Sun Hours) | | 1500 | ) | Formulation |
| | | | ) | used |
| Resistance to Burial | | Pass USBR | ) - | previously |
| | | | ) | tested |
| Alkali Resistance | | Pass CRD-572-61 | ) | satisfactorily |
| Pinholes/10 Sq.Yd. (Max.) | | 1 | | OK |

Spec Number : 64-03-3730-92-3
Compound Number: 23-677
Production Date: July 21, 1986
Roll Numbers : 9522 representing
14680 through 14736 and
9495 through 9576

BFGoodrich Company
Industrial Products Division

Thomas R. Ward

Thomas R. Ward
Technical Manager

TRW:mbf

The BFGoodrich Company
P. O. Box 457
Marietta, Ohio 45750

September 23, 1986

# LABORATORY TEST REPORT
## 30 MIL VINYL SHEET

| Physical Properties | | Requirement | Test Method | Test Results |
|---|---|---|---|---|
| Specific Gravity | | 1.24-1.30 | BFG Method | 1.26 |
| Thickness (Inches) | | ±5% | ASTM D1593 | .0311 |
| Tensile (psi, Min.) | M | 2400 | ASTM D882 | 2750 |
| | T | 2400 | | 2630 |
| Elongation (%, Min.) | M | 400 | ASTM D882 | 470 |
| | T | 400 | | 525 |
| 100% Modulus (psi, Range) | M | 1000-1600 | ASTM D882 | 1389 |
| | T | 1000-1600 | | 1298 |
| Graves Tear | M | 320 | ASTM D1004-49T | 405 |
| (Lbs./In., Min.) | T | 320 | | 380 |
| Water Extraction (%, Max.) | | 0.35 | ASTM D1239 | +0.25 |
| olatility | | 0.70 | ASTM D1203-55T | 0.50 |
| Impact Cold Crack (°F, Max.) | | -20 | ASTM D1790 | Material passes |
| Dimensional Stability | M | 5 | ASTM D1204 | -1.9 |
| (%, Max.) | T | 5 | 100°C/15 Min. | +0.6 |
| Shore Durometer "A" (Range) | | 93 ±3 | ASTM D676 | 91 |
| Outdoor Exposure (Sun Hours) | | 1500 | ) | Formulation |
| Resistance to Burial | | Pass USBR | ) - | used previously |
| Alkali Resistance | | Pass CRD-572-61 | ) | tested satisfactorily |
| Pinholes/10 Sq.Yd. (Max.) | | 1 | | OK |

Spec Number : 64-03-3730-92-3
Compound Number: 23-677
Production Date: August 27, 1986
Roll Numbers : 9597 representing
9577 through 9650

BFGoodrich Company
Industrial Products Division

Thomas R. Ward

Thomas R. Ward
Technical Manager

TRW:mbf

RECEIVED OCT 7 1986

BFGoodrich

The BFGoodrich Company
P. O. Box 657
Marietta, Ohio 45750
(614) 373-6611

September 29, 1986

# LABORATORY TEST REPORT
## 30 MIL VINYL SHEET

| Physical Properties | | Requirement | Test Method | Test Results |
|---|---|---|---|---|
| Specific Gravity | | 1.24-1.30 | BFG Method | 1.26 |
| Thickness (Inches) | | ±5% | ASTM D1593 | .0306 |
| Tensile (psi, Min.) | M | 2400 | ASTM D882 | 2875 |
| | T | 2400 | | 2815 |
| Elongation (%, Min.) | M | 400 | ASTM D882 | 480 |
| | T | 400 | | 550 |
| 100% Modulus (psi, Range) | M | 1000-1600 | ASTM D882 | 1423 |
| | T | 1000-1600 | | 1278 |
| Graves Tear | M | 320 | ASTM D1004-49T | 402 |
| (Lbs./In., Min.) | T | 320 | | 382 |
| Water Extraction (%, Max.) | | 0.35 | ASTM D1239 | +0.32 |
| Volatility (%, Max.) | | 0.70 | ASTM D1203-55T | 0.42 |
| Impact Cold Crack (°F, Max.) | | -20 | ASTM D1790 | Material passes |
| Dimensional Stability | M | 5 | ASTM D1204 | -2.2 |
| (%, Max.) | T | 5 | 100°C/15 Min. | +0.3 |
| Shore Durometer "A" (Range) | | 93 ±5 | ASTM D676 | 92 |
| Outdoor Exposure (Sun Hours) | | 1500 | ) | Formulation |
| Resistance to Burial | | Pass USBR | ) - | used previously |
| Alkali Resistance | | Pass CRD-572-61 | ) | tested satisfactorily |
| Pinholes/10 Sq.Yd. (Max.) | | 1 | | OK |

Spec Number : 64-03-3730-92-3
Compound Number: 23-677
Production Date: August 28, 1986
Roll Numbers : 9672 representing
9651 through 9699 and
339676 through 339709

BFGoodrich Company
Industrial Products Division

Thomas R. Ward

Thomas R. Ward
Technical Manager

TRW:mbf

Dynamit Nobel

DYNAMIT NOBEL OF AMERICA INC. 10 LINK DRIVE, ROCKLEIGH, NEW JERSEY 07647 PHONE (201) 767-1660 TELEX 685-3565

CUSTOMER: Staff Industries, Inc

DNA ORDER NO.: 109736-001

ICKNESS: 30 mil

ROLLS TESTED: 3,9,12,17,23,30,36,42,48,54,6
73,76,82,88,92,98,104,110,11
124,129,134,138,143

PRODUCT NO.: 1952

COLOR NO.: 60570 Grey

TEST REPORT DATE: October 31, 1986

PRODUCED WEEK OF: July 20, 1986

| PROPERTY | | SPECIFICATION | TEST VALUE | TEST METHOD |
|---|---|---|---|---|
| Thickness (mils) | | 28.5 | 29.5 | ASTM D-1593 |
| Specific Gravity, min | | 1.24-1.30 | 1.25 | ASTM D-792 |
| Tensile Strength min psi | MD | 2400 (72) | 2759 | ASTM D-882 |
| | TD | 2400 (72) | 2562 | |
| Modulus @ 100% Elongation min psi | MD | 900 (27) | 1350 | ASTM D-882 |
| | TD | 900 (27) | 1232 | |
| Elongation, % min | MD | 400 | 493 | ASTM D-882 |
| | TD | 400 | 472 | |
| Tear Resistance: | | | | |
| Graves (lbs/in min) | MD | 320 (9.6) | 416 | ASTM D-1004 |
| | TD | 320 (9.6) | 437 | |
| Low Temperature Impact, °F | | -20° | Pass | ASTM D-1790 |
| Volatility, % Loss max (70°C for 24 hours) | | .70 | .69 | ASTM D-1203 |
| Water Extraction, % Loss max (@ 104°F for 24 hours) | | .35 | 0.19 | ASTM D-1239 |
| Dimensional Stability, % Change max (@ 212°F for 15 mins.) | MD | 5.0 | -1.90 | ASTM D-1204 |
| | TD | 5.0 | +1.13 | |
| Resistance to Soil Burial: | | | | ASTM D-3083 |
| a) Tensile Strength, % Loss max | | 5 | Pass | |
| b) Elongation, % Loss max | | 20 | Pass | |
| c) Modulus, % Gain max | | 20 | Pass | |

Arthur A. Arena, Technical Director

CC: P. Sawhney, A. Diamanti, V. Fumanti, M. K. Aston,
Lab (3), Project No. 48-058

FMC Corporation
Air Drying Precipitator Slurry
Pocatello, Idaho

Roadways and Surfaced Areas

Project No. C84-06

## Specification For Roadways & Surfaced Areas

### REVISIONS

Each time a new page is added to this specification, or an existing page is revised, only this revisions page reissues with the new or revised pages.

| REV. | DATE | BY | PAGE | REMARKS |
|---|---|---|---|---|
| A | 2/15/79 | MS | All | Issued for Approval |
| O | 6/04/79 | MS | All | Issued for Construction |
| 1 | 7/20/81 | RPR | All | Reissued for Construction |
| 2 | 6/19/84 | PSG | All | Issued for Construction (C84-06) |

## Specification For Roadways & Surfaced Areas

### 1.0 SCOPE

This specification covers the requirements for the construction of the aggregate base course and bituminous surface course for plant roadways and surfaced areas.

### 2.0 STANDARDS

The following standards form a part of this specification:

ASTM Standards

| | |
|---|---|
| C131-76 | Resistance to abrasion of small size coarse aggregate by use of the Los Angeles Machine |
| C136-71 | Sieve or Screen Analysis of Fine and Coarse Aggregate |
| D424-59 | Plastic Limit and Plasticity Index of Soils |
| D1561-76 | Compaction of test specimens of Bituminous Mixtures by means of California Kneading Compactor |
| D1557-70 | Moisture-Density Relations of Soils using the 10 lb Rammer and 18 inch drop |

### 3.0 AGGREGATE BASE COURSE

#### 3.1 Material

Aggregates shall consist of clean, sound, durable particles of crushed slag. The subcontractor shall be responsible for obtaining materials that meet the requirements herein and can be used to meet the grade and smoothness requirements specified herein, after all compaction and proof rolling operations have been completed. The aggregates shall be free of silt, clay, and organic and other objectionable materials or coatings. These materials shall be furnished by Bannock Paving Co. Aggregates shall be well graded and shall conform to the following limits, or as designated by the engineer:

Specification For Roadways & Surfaced Areas

3.0 AGGREGATE BASE COURSE - continued

3.1 Material - continued

| Passing Sieve Size | Percentage by Weight |
|---|---|
| 2 Inch | 100 |
| 1-1/2 Inch | 87-100 |
| 3/4 Inch | 45-90 |
| No. 4 | 20-50 |
| No. 30 | 6-29 |
| No. 200 | 0-12 |

Gradation of aggregate shall be determined by ASTM C136. Aggregate material shall have a percentage wear not to exceed 50 percent after 500 revolutions when tested as specified in ASTM 131 (Test Grading B).

3.2 Placement

Prior to constructing the slag base course, the previously prepared subgrade shall be cleaned of all foreign substances. Ruts, spongy areas, or areas with inadequate compaction shall be corrected to line and grade and to specified requirements.

Where the required base thickness is 6 inches or less, the base material may be spread and compacted in one layer on the prepared subgrade. Where the required thickness is more than 6 inches, the base material shall be spread and compacted in two or more layers of approximately equal thickness. The maximum compacted thickness of each layer shall be 6 inches. The water content of the material shall be maintained so as to obtain the required compaction.

Each layer shall be compacted by rolling along lines parallel with the road centerline. In all places not accessible to rollers, the base course material shall be compacted by mechanical tampers. The base material shall be compacted to at least 95% of the maximum dry density as determined by ASTM D1557. The surface of the finished aggregate base at any point shall not vary more than 1/2 inch from the grade established by the

Specification For Roadways & Surfaced Areas

3.0 AGGREGATE BASE COURSE - continued

3.2 Placement - continued

engineer. In no case shall thin layers of material be added to the top layer of base course in order to meet grade. Base that does not conform to the above requirements shall be reshaped or reworked, watered, and recompacted to the specified requirements.

The slag course, as specified above, shall serve as the surface course for the top of the pond dikes.

**FMC Corporation**
Air Drying Precipitator Slurry
**Pocatello, Idaho**

Slurry Drying pond
Grading and Earthwork

**Project No.** C84-06

Specificiation For Grading & Earthwork

REVISIONS

Each time a new page is added to this specification, or an existing page is revise only this revisions page reissues with the new or revised pages.

| REV. | DATE | BY | PAGE | REMARKS |
|---|---|---|---|---|
| A | 1/17/79 | MS | All | Issued for Approval |
| 1 | 7/31/79 | RLA | 2 | Par. 5.0 |
| 2 | 7/20/81 | RPR | All | Reissued for Construction |
| 3 | 6/19/84 | PSG | All | Issued for Construction (C84-06) |

## Specification For Grading & Earthwork

### 1.0 SCOPE

This specification covers the requirements for all excavation, grading and associated operations for the Slurry Drying Pond.

### 2.0 STANDARDS

#### 2.1 ASTM Standards

D-1556-64 Density of Soil in Place by the Sand Cone Method
D-1557-70 Moisture-Density Relations of Soils Using 10 Lb. Rammer and 18 Inch Drop
D-2167-66 Density of Soil In Place by the Rubber Balloon Method

2.2 Uniform Building Code, latest edition.

2.3 Latest edition of the Standards of the Occupational Safety and Health Administration (OSHA)

### 3.0 SOILS ENGINEER

To assist the earthwork subcontractor in meeting specifications, the soils engineer shall be present to conduct density checks, to determine the quality of on-site soils, to inspect and approve imported fill materials and to carry-out such tests as may be required.

### 4.0 LAYOUT OF WORK

The subcontractor shall establish and maintain lines, levels and centers required for the proper performance of all operations. The subcontractor shall verify the accuracy of the horizontal and vertical control reference points provided by the owner and, if necessary, establish a bench mark for future base reference.

### 5.0 EXCAVATION

The pond shall be stripped of mud, debris, and organic matter to the approximate depth of the proposed pond.

Specification For Grading & Earthwork

5.0 EXCAVATION - continued

Such unsuitable material shall be disposed of on-site as directed by the engineer. Near surface compressible soils shall be excavated and recompacted if more than one foot thick, or compacted in place if less than one foot thick. The exposed subgrade shall be scarified to a depth of 12 inches, moistened as required to obtain optimum moisture, and compacted as specified.

Excavated slopes shall be finished in conformance with the lines and grades shown on the plans. All debris and loose material shall be removed.

Excavation shall be performed in a manner and sequence that will provide drainage at all times. Excavation shall be kept free from water while construction is in progress.

Surplus excavated material shall be disposed of on-site as directed by the engineer.

6.0 EMBANKMENTS

Excavated on-site material is considered satisfactory for reuse in the controlled fill. Fill material shall be free of organic material, trash, and stones greater than six inches in maximum dimension. In some cases large rocks, boulders, or hard lumps over six inches in diameter that have been excavated from the site, may be incorporated into the fill subject to the approval of the engineer. The location, depth, and method of its placement shall be approved by the engineer. Imported fill shall be non-expansive and approved by the engineer prior to use. Areas over which fills are to be placed shall be scarified to provide a bond between existing ground and fill material. Fill and backfill shall be placed in successive horizontal layers not exceeding 12 inches in loose thickness at optimum moisture content. Precise lift thickness is contingent upon the type of compaction equipment used and shall be determined by the engineer. Fill and backfill shall be placed in a manner and sequence that will provide drainage at all times during construction.

Each layer of fill shall be compacted using medium to heavy vibratory compaction equipment to be approved by the engineer. At the time of compaction, the moisture content of the fill material shall be controlled so as to obtain the specified compaction. Interior embank-

Specification For Grading & Earthwork

6.0 EMBANKMENTS - continued

ment slopes shall be dressed smooth and rolled to receive the lining material.

Pond dikes shall be compacted to at least 95% relative compaction. The words "relative compaction" used herein and on the construction plans, shall be defined as the ratio of field dry density to the laboratory maximum dry density as determined by ASTM D-1557. Compaction to 90% will suffice for areas not supporting roadways or other structures.

The finished top of dike surface (excluding the roadway surface) shall not vary more than 0.10 foot from the established grade and cross section.

7.0 POND BOTTOM

The prepared surface that will receive the liner shall be free from roots, brush, loose earth, rock, cobbles, rubbish, or other foreign materials. Rock ledges, or immovable objects shall be covered with a minimum of six inches of sand or compacted earth.

The pond bottom shall be scarified, watered, mixed and compacted using medium to heavy vibratory compaction equipment and steel wheeled tandem rollers to be approved by the engineer. Pond bottom shall be compacted to at least 90% relative compaction. The completed bottom shall be smooth and free from sudden changes in grade. The finished surface shall not vary more than 0.15 foot from the established grade.

## 8.0 STANDARDS

### 8.1 Material

A six inch layer of bedding material shall be placed under each liner. The bedding material shall consist of materials no coarser than sand (SP) as defined by the Uniform Soil Classification System (USCS).

Each Liner is to have a protective covering of 12 inches of earth. The top liner shall be covered with an additional 6 to 24 inch layer of crushed slag as shown on the drawings.

The material obtained from the Pond area excavation shall be suitable for the bedding & earth cover, provided all organic material, sticks, trash, and sharp rocks are first removed. ~~The material covering the bottom liner shall have a hydraulic conductivity not less than $1X10^{-3}$ CM/SEC~~. No pieces larger than two (2) inches shall be placed within the bottom six (6) inches of this liner anchor material. No piece larger than four (4) inches shall be placed within the top six (6) inches of the top liner's anchor material. This material shall be reasonably even graded and free draining.

### 8.2 Crushed Slag

The crushed slag material shall be as specified in the Specification for Roadways and Surfaced Areas, for Aggregate Base Course, except that it shall conform to the following limits:

| Passing Sieve Size | Percent by Weight |
|---|---|
| 3-1/2 Inch | 90 - 100 |
| 2-1/2 Inch | 25 - 60 |
| 1-1/2 Inch | 0 - 15 |
| 3/4 Inch | 0 - 5 |

Application

The liner anchor courses shall be distributed over the area required, as shown on the drawings. The depth shall be as required to provide a finish depth as shown on the drawings after being compacted using compaction equipment to be approved by the engineer. Grading equipment shall not be driven directly on the liner, except as directed by the engineer. The finished surface shall be smooth and true to the line and grade as indicated on the drawings.

## 9.0 INSTALLATION OF UNDER DRAIN AND LEAK DETECTION

### 9.1 Permeable Under Drain Material

Permeable material for backfilling around perforated under drain pipe shall consist of hard, durable, clean 1½" drain rock, and shall be free from organic material, clay balls or other deleterious substances.

### 9.2 Trenching, Bedding, Installation, and Backfill

The subcontractor shall perform all excavation, trenching, and backfilling to satisfactorily install the under drain system as specified herein and as shown on the drawings. The subcontractor shall be responsible for the protection of tubing from deformation or floating, as well as the intrusion of material into the tubing, due to unstable trench walls or bottom.

The trench shall be excavated to a depth to provide for the envelope of under drain material. The under drain material shall be installed around the perforated tubing to provide for proper bedding support. If the trench is wider than shown on the drawings, the trench shall be filled on both sides with under drain materials so there are no void spaces between the tubing and the walls of the trench.

The under drain material shall be placed carefully to form an even, firm bedding without disturbing the tubing grade and alignment. Mud, excavated material, or foreign matter shall not be permitted to mix with the under drain material during installation. Grading equipment shall not be driven directly over the installed under drain pipe during construction.

Filter fabric shall be placed over the drain material before placing the 12 inch layer of earth to protect the liner.

### 9.3 Observation Manholes

Excavation for observation manholes shall be made accurately to the lines, grades, and elevation shown on the plans. Foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of the structure foundation. Rock or other hard foundation material shall be cleaned of loos debris and cut to a firm surface. Loose disintegrated rock and thin strata shall be removed. When concrete is to be placed against an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until the concrete is to be placed.

Backfilling around the concrete or masonry structure shall not be started until the concrete or mortar has sufficiently hardened to prevent damage to the structure.

# Appendix D-5

Precipitator Slurry
Surface Impoundment (8E)

STAFF INDUSTRIES INC.

# 30 Mil Polyvinyl Chloride (PVC) Specification

## 1. SCOPE

The work covered by these specifications shall consist of the supply and installation of the 30 Mil Polyvinyl Chloride (PVC) liner.

All work shall be done in accordance with the engineer's drawings and these specifications.

## 2. INSTALLER'S EXPERIENCE

Any contractor proposing to install the liner shall have demonstrated his ability to do the work by having successfully installed a minimum of two million square feet of PVC liner, or shall obtain the services of an experienced liner installer from the liner fabricator to assist in liner installation.

## 3. LINING MATERIAL

3.1 The 30 Mil PVC liner supplied under these specifications shall be first quality product manufactured specifically for the purpose of this work and which has been satisfactorily demonstrated by prior use to be suitable for such purposes.

3.2 The contractor or installer shall, at the time of bidding, supply the engineer with the name of the lining fabricator who has demonstrated his ability to do the work by having successfully fabricated a minimum of ten million square feet of 30 Mil PVC liners.

3.3 The PVC lining shall consist of a single ply of sheeting, minimum 60 inches wide, to be PVC-adhesive bonded into a single piece or into the minimum number of large panels required to line the facility.

3.4 Liner manufacturer shall supply a certified test report that the 30 Mil PVC material supplied meets or exceeds the physical properties as outlined on the reverse side of this sheet.

## 4. FACTORY FABRICATION

The PVC roll goods shall be fabricated into large panels by PVC-adhesive bonding into a single panel or the minimum number of panels up to 110' wide, in increments of 5 feet, as are required to line the facility. Bonded area shall be a minimum one inch wide. After fabrication, panels shall be accordian folded in both directions into palletized-heavy cardboard containers.

**taff Industries, Inc.**
**.40 Chene St. Detroit, MI 48207**
**313/259-1818 800/526-1368 Telex Staff Intl. Det. 810-221-9625**

## MATERIAL PROPERTIES

| PROPERTY | TEST METHOD | VALUES |
|---|---|---|
| Gauge (nominal) | — — — | 30 |
| Thickness, mil minimum | ASTM D1593 Para 8.1.3 | 28.5 |
| Specific Gravity (range) | ASTM D792 Method A | 1.20-1.30 |
| Minimum Tensil Properties (each direction) | ASTM D882 | |
| 1. Breaking Factor (pounds/inch width) | Method A or B (1 inch wide) | 72 |
| 2. Elongation at Break (percent) | Method A or B | 300 |
| 3. Modulus (force) at 100% Elongation (pounds/inch width) | Method A or B | 30 |
| Tear Resistance (pounds, minimum) | ASTM D1004 Die C | 9 |
| Low Temperature, °F | ASTM D1790 | – 20 |
| Dimensional Stability (each direction, percent change maximum) | ASTM D1204 212°F, 15 min. | 5 |
| Water Extraction (percent loss maximum) | ASTM D3083 (as modified in NSF #54*) | – 0.35 |
| Volatile Loss (percent loss maximum) | ASTM D1203 Method A | .7 |
| Resistance to Soil Burial (percent change maximum in original value) | ASTM D3083 (as modified in NSF #54) | |
| 1. Breaking Factor | | 5 |
| 2. Elongation at Break | | 20 |
| 3. Modulus at 100% Elongation | | 20 |
| Hydrostatic Resistance (pounds/sq. in. minimum) | ASTM D751 Method A | 82 |

## FACTORY SEAM REQUIREMENTS

| | | |
|---|---|---|
| Bonded Seam Strength (factory seam, breaking factor, ppi width) | ASTM D3083 (as modified in NSF #54) | 55.2 |
| Peel Adhesion (pounds/in. minimum) | ASTM D413 (as modified in NSF #54) | FTB or 10 lb./in. |
| Resistance to Soil Burial (percent change maximum in original value) | ASTM D3083 (as modified in NSF #54) | |
| Peel Adhesion | | – 20 |
| Bonded Seam Strength | | – 20 |

(National Sanitation Foundation Standard Number 54).

SI 83-210

FMC
Air Drying Precipitator
Slurry
Pocatello, Idaho

Slurry Drying Pond
30 MIL PVC Lining

Project No. C84-06

## Specification for Pond Liner

### REVISIONS

Each time a new page is added to this specification, or an existing page is revised, only this revisions page reissues with the new or revised pages.

| REV. | DATE | BY | PAGE | REMARKS |
|---|---|---|---|---|
| A | 1/18/79 | MS | All | Issued for Approval |
| O | 6/04/79 | MS | All | Issued for Construction |
| 1 | 7/16/81 | RPR | All | Reissued for Constructi |
| 2 | 6/19/84 | PSG | All | Issued for Construction (C84-06) |

| FMC Air Drying Precipitator Slurry | Slurry Drying Pond 30 MIL PVC Lining | Project No. C84-06 |
|---|---|---|

## Specification for Pond Liner

### 1.0 SCOPE

This specification covers the requirements for furnishing and installing a polyvinyl chloride (PVC) plastic bottom and embankment liner, and liner protection blanketing, for the Slurry Drying Pond.

### 2.0 MATERIALS

#### 2.1 PVC Materials

The materials furnished under these specifications shall be first quality products designed and manufactured for the purposes of this work and which have been satisfactorily demonstrated by prior use to be suitable and durable for such purposes.

The PVC lining shall consist of standard widths of calendered polyvinyl chloride sheeting, neutral gray to black in color, 30 mils in thickness, and fabricated into the minimum number of large pieces required to fit the facility. The sheeting shall be manufactured from domestic virgin polyvinyl chloride resin and specifically compounded for use in hydraulic facilities. Reprocessed material shall not be used. The PVC materials shall have the following physical characteristics:

| Test | Typical Test Values | Test Method |
|---|---|---|
| Thickness | ± 5% | ASTM-D1593 |
| Specific Gravity | 1.23 | ASTM-D792A |
| Tensile Strength, lbs/in width | 66 | ASTM-D882B |
| Elongation, % min. | 325 | ASTM-D882B |
| 100% Modulus, lbs/in | 30 | ASTM-D882B |
| Elmendorfer Tear, gms | 6000 | ASTM-D1922 |
| Graves Tear, lbs/min | 8.25 | ASTM-D1004 |
| Water Extraction, % max. | 0.15 | ASTM-D1239 |
| Volatility, % max. | 0.75 | ASTM-D1203A |
| Impact Cold Crack, °F | -20 | ASTM-1790 |
| Dimensional Stability, max. % (100°C - 15 minutes) | 5 | |
| Resistance to Burial | | Para. 4C (1) per |
| Tensile Strength Loss | 5.0 | Bur. of Reclamatio |
| Elongation Loss | 20.0 | Procedure |

Specification for Pond Liner

## 3.0 FACTORY FABRICATION

Individual calendered widths of lining materials shall be fabricated into large sections by solvent bonding into a minimum number of pieces that can be readily handled, as required to fit the installation. Lap joints with a minimum width of 1/2 inch shall be used. Joints shall meet the seam strength of 80 percent of the specified sheet strength. After fabrication, the lining shall be accordion folded in both directions, and packaged for minimum handling in the field.

## 4.0 FIELD INSTALLATION

### 4.1 Preparation

The ponds to receive the lining shall be constructed by others, but shall be the responsibility of the lining contractor to inspect the finished surface and correct any irregularities and deformities which might adversely affect a satisfactory liner installation. All vegetation must be removed. A soil sterilant may be required at the discretion of the engineer.

### 4.2 Lining Application

The lining shall be installed in such a manner as to assure minimum handling. The lining shall be closely sealed around inlets and outlets as shown on the drawings. Any portion of lining damaged during installation, by any cause, shall be removed or repaired by using additional lining material bonded to the in-place liner with the appropriate adhesive (see Paragraph 4.3) according to the manufacturer's recommendations.

### 4.3 Field Joints

Lap joints shall be used to seal factory fabricated pieces of lining together in the field. Lap joints shall be formed by lapping the edges of pieces a minimum of 2 inches. The contact surfaces shall be wiped clean to remove all dirt, dust, moisture, or other foreign materials. Sufficient cold-applied vinyl-to-vinyl adhesive shall be applied to both contact surfaces in the joint area and the two surfaces shall be pressed together immediately. Any wrinkles shall be removed. Ratios of solvents to adhesives shall be in accordance with the manufacturer's recommendations for the lining materials being joined. Field made splices shall have a strength of 80 percent of the specified sheet strength.

## Specification for Pond Liner

4.0 FIELD INSTALLATION - continued

### 4.4 Completion

All joints, on completion of the work, shall be tightly bonded. Any lining surface damaged due to scuffing, penetration by foreign objects, or distress from rough subgrade shall, as directed by the engineer, be replaced or covered and sealed with an additional layer of PVC of adequate size.

| FMC Corporation<br>Air Drying Precipitator Slurry<br>Pocatello, Idaho | Roadways and Surfaced Areas | Project No. C84-06 |
|---|---|---|

## Specification For Roadways & Surfaced Areas

### REVISIONS

Each time a new page is added to this specification, or an existing page is revised, only this revisions page reissues with the new or revised pages.

| REV. | DATE | BY | PAGE | REMARKS |
|---|---|---|---|---|
| A | 2/15/79 | MS | All | Issued for Approval |
| O | 6/04/79 | MS | All | Issued for Construction |
| 1 | 7/20/81 | RPR | All | Reissued for Construction |
| 2 | 6/19/84 | PSG | All | Issued for Construction (C84-06) |

## Specification For Roadways & Surfaced Areas

### 1.0 SCOPE

This specification covers the requirements for the construction of the aggregate base course and bituminous surface course for plant roadways and surfaced areas.

### 2.0 STANDARDS

The following standards form a part of this specification:

ASTM Standards

| | |
|---|---|
| C131-76 | Resistance to abrasion of small size coarse aggregate by use of the Los Angeles Machine |
| C136-71 | Sieve or Screen Analysis of Fine and Coarse Aggregate |
| D424-59 | Plastic Limit and Plasticity Index of Soils |
| D1561-76 | Compaction of test specimens of Bituminous Mixtures by means of California Kneading Compactor |
| D1557-70 | Moisture-Density Relations of Soils using the 10 lb Rammer and 18 inch drop |

### 3.0 AGGREGATE BASE COURSE

#### 3.1 Material

Aggregates shall consist of clean, sound, durable particles of crushed slag. The subcontractor shall be responsible for obtaining materials that meet the requirements herein and can be used to meet the grade and smoothness requirements specified herein, after all compaction and proof rolling operations have been completed. The aggregates shall be free of silt, clay, and organic and other objectionable materials or coatings. These materials shall be furnished by Bannock Paving Co. Aggregates shall be well graded and shall conform to the following limits, or as designated by the engineer:

Specification for Roadways & Surfaced Areas

3.0 AGGREGATE BASE COURSE - continued

3.1 Material - continued

| Passing Sieve Size | Percentage by Weight |
|---|---|
| 2 Inch | 100 |
| 1-1/2 Inch | 87-100 |
| 3/4 Inch | 45-90 |
| No. 4 | 20-50 |
| No. 30 | 6-29 |
| No. 200 | 0-12 |

Gradation of aggregate shall be determined by ASTM C136. Aggregate material shall have a percentage wear not to exceed 50 percent after 500 revolutions when tested as specified in ASTM 131 (Test Grading B).

3.2 Placement

Prior to constructing the slag base course, the previously prepared subgrade shall be cleaned of all foreign substances. Ruts, spongy areas, or areas with inadequate compaction shall be corrected to line and grade and to specified requirements.

Where the required base thickness is 6 inches or less, the base material may be spread and compacted in one layer on the prepared subgrade. Where the required thickness is more than 6 inches, the base material shall be spread and compacted in two or more layers of approximately equal thickness. The maximum compacted thickness of each layer shall be 6 inches. The water content of the material shall be maintained so as to obtain the required compaction.

Each layer shall be compacted by rolling along lines parallel with the road centerline. In all places not accessible to rollers, the base course material shall be compacted by mechanical tampers. The base material shall be compacted to at least 95% of the maximum dry density as determined by ASTM D1557. The surface of the finished aggregate base at any point shall not vary more than 1/2 inch from the grade established by the

Specification For Roadways & Surfaced Areas

3.0 AGGREGATE BASE COURSE - continued

3.2 Placement - continued

engineer. In no case shall thin layers of material be added to the top layer of base course in order to meet grade. Base that does not conform to the above requirements shall be reshaped or reworked, watered, and recompacted to the specified requirements.

The slag course, as specified above, shall serve as the surface course for the top of the pond dikes.

**FMC Corporation**
Air Drying Precipitator Slurry
**Pocatello, Idaho**

Slurry Drying pond
Grading and Earthwork

**Project No.** C84-06

Specificiation For Grading & Earthwork

REVISIONS

Each time a new page is added to this specification, or an existing page is revise only this revisions page reissues with the new or revised pages.

| REV. | DATE | BY | PAGE | REMARKS |
|---|---|---|---|---|
| A | 1/17/79 | MS | All | Issued for Approval |
| 1 | 7/31/79 | RLA | 2 | Par. 5.0 |
| 2 | 7/20/81 | RPR | All | Reissued for Construction |
| 3 | 6/19/84 | PSG | All | Issued for Construction (C84-06) |

## Specification For Grading & Earthwork

### 1.0 SCOPE

This specification covers the requirements for all excavation, grading and associated operations for the Slurry Drying Pond.

### 2.0 STANDARDS

#### 2.1 ASTM Standards

| | |
|---|---|
| D-1556-64 | Density of Soil in Place by the Sand Cone Method |
| D-1557-70 | Moisture-Density Relations of Soils Using 10 Lb. Rammer and 18 Inch Drop |
| D-2167-66 | Density of Soil In Place by the Rubber Balloon Method |

2.2 Uniform Building Code, latest edition.

2.3 Latest edition of the Standards of the Occupational Safety and Health Administration (OSHA)

### 3.0 SOILS ENGINEER

To assist the earthwork subcontractor in meeting specifications, the soils engineer shall be present to conduct density checks, to determine the quality of on-site soils, to inspect and approve imported fill materials and to carry-out such tests as may be required.

### 4.0 LAYOUT OF WORK

The subcontractor shall establish and maintain lines, levels and centers required for the proper performance of all operations. The subcontractor shall verify the accuracy of the horizontal and vertical control reference points provided by the owner and, if necessary, establish a bench mark for future base reference.

### 5.0 EXCAVATION

The pond shall be stripped of mud, debris, and organic matter to the approximate depth of the proposed pond.

Specification For Grading & Earthwork

5.0 EXCAVATION - continued

Such unsuitable material shall be disposed of on-site as directed by the engineer. Near surface compressible soils shall be excavated and recompacted if more than one foot thick, or compacted in place if less than one foot thick. The exposed subgrade shall be scarified to a depth of 12 inches, moistened as required to obtain optimum moisture, and compacted as specified.

Excavated slopes shall be finished in conformance with the lines and grades shown on the plans. All debris and loose material shall be removed.

Excavation shall be performed in a manner and sequence that will provide drainage at all times. Excavation shall be kept free from water while construction is in progress.

Surplus excavated material shall be disposed of on-site as directed by the engineer.

6.0 EMBANKMENTS

Excavated on-site material is considered satisfactory for reuse in the controlled fill. Fill material shall be free of organic material, trash, and stones greater than six inches in maximum dimension. In some cases large rocks, boulders, or hard lumps over six inches in diameter that have been excavated from the site, may be incorporated into the fill subject to the approval of the engineer. The location, depth, and method of its placement shall be approved by the engineer. Imported fill shall be non-expansive and approved by the engineer prior to use. Areas over which fills are to be placed shall be scarified to provide a bond between existing ground and fill material. Fill and backfill shall be placed in successive horizontal layers not exceeding 12 inches in loose thickness at optimum moisture content. Precise lift thickness is contingent upon the type of compaction equipment used and shall be determined by the engineer. Fill and backfill shall be placed in a manner and sequence that will provide drainage at all times during construction.

Each layer of fill shall be compacted using medium to heavy vibratory compaction equipment to be approved by the engineer. At the time of compaction, the moisture content of the fill material shall be controlled so as to obtain the specified compaction. Interior embank-

Specification For Grading & Earthwork

6.0 EMBANKMENTS - continued

ment slopes shall be dressed smooth and rolled to receive the lining material.

Pond dikes shall be compacted to at least 95% relative compaction. The words "relative compaction" used herein and on the construction plans, shall be defined as the ratio of field dry density to the laboratory maximum dry density as determined by ASTM D-1557. Compaction to 90% will suffice for areas not supporting roadways or other structures.

The finished top of dike surface (excluding the roadway surface) shall not vary more than 0.10 foot from the established grade and cross section.

7.0 POND BOTTOM

The prepared surface that will receive the liner shall be free from roots, brush, loose earth, rock, cobbles, rubbish, or other foreign materials. Rock ledges, or immovable objects shall be covered with a minimum of six inches of sand or compacted earth.

The pond bottom shall be scarified, watered, mixed and compacted using medium to heavy vibratory compaction equipment and steel wheeled tandem rollers to be approved by the engineer. Pond bottom shall be compacted to at least 90% relative compaction. The completed bottom shall be smooth and free from sudden changes in grade. The finished surface shall not vary more than 0.15 foot from the established grade.

**FMC Corporation**
Air Drying Precipitator Slurry Drying Pond
Slurry Grading and Earthwork
**Pocatello, Idaho**

**Project No.** C84-06

## 8.0 STANDARDS

### 8.1 Material

A six inch layer of bedding material shall be placed under each liner. The bedding material shall consist of materials no coarser than sand (SP) as defined by the Uniform Soil Classification System (USCS).

Each Liner is to have a protective covering of 12 inches of earth. The top liner shall be covered with an additional 6 to 24 inch layer of crushed slag as shown on the drawings.

The material obtained from the Pond area excavation shall be suitable for the bedding & earth cover, provided all organic material, sticks, trash, and sharp rocks are first removed. ~~The material covering the bottom liner shall have a hydraulic conductivity not less than $1X10^{-3}$ CM/SEC~~. No pieces larger than two (2) inches shall be placed within the bottom six (6) inches of this liner anchor material. No piece larger than four (4) inches shall be placed within the top six (6) inches of the top liner's anchor material. This material shall be reasonably even graded and free draining.

### 8.2 Crushed Slag

The crushed slag material shall be as specified in the Specification for Roadways and Surfaced Areas, for Aggregate Base Course, except that it shall conform to the following limits:

| Passing Sieve Size | Percent by Weight |
|---|---|
| 3-1/2 Inch | 90 - 100 |
| 2-1/2 Inch | 25 - 60 |
| 1-1/2 Inch | 0 - 15 |
| 3/4 Inch | 0 - 5 |

Application

The liner anchor courses shall be distributed over the area required, as shown on the drawings. The depth shall be as required to provide a finish depth as shown on the drawings after being compacted using compaction equipment to be approved by the engineer. Grading equipment shall not be driven directly on the liner, except as directed by the engineer. The finished surface shall be smooth and true to the line and grade as indicated on the drawings.

## 9.0 INSTALLATION OF UNDER DRAIN AND LEAK DETECTION

### 9.1 Permeable Under Drain Material

Permeable material for backfilling around perforated under drain pipe shall consist of hard, durable, clean 1½" drain rock, and shall be free from organic material, clay balls or other deleterious substances.

### 9.2 Trenching, Bedding, Installation, and Backfill

The subcontractor shall perform all excavation, trenching, and backfilling to satisfactorily install the under drain system as specified herein and as shown on the drawings. The subcontractor shall be responsible for the protection of tubing from deformation or floating, as well as the intrusion of material into the tubing, due to unstable trench walls or bottom.

The trench shall be excavated to a depth to provide for the envelope of under drain material. The under drain material shall be installed around the perforated tubing to provide for proper bedding support. If the trench is wider than shown on the drawings, the trench shall be filled on both sides with under drain materials so there are no void spaces between the tubing and the walls of the trench.

The under drain material shall be placed carefully to form an even, firm bedding without disturbing the tubing grade and alignment. Mud, excavated material, or foreign matter shall not be permitted to mix with the under drain material during installation. Grading equipment shall not be driven directly over the installed under drain pipe during construction.

Filter fabric shall be placed over the drain material before placing the 12 inch layer of earth to protect the liner.

### 9.3 Observation Manholes

Excavation for observation manholes shall be made accurately to the lines, grades, and elevation shown on the plans. Foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of the structure foundation. Rock or other hard foundation material shall be cleaned of loos debris and cut to a firm surface. Loose disintegrated rock and thin strata shall be removed. When concrete is to be placed against an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until the concrete is to be placed.

Backfilling around the concrete or masonry structure shall not be started until the concrete or mortar has sufficiently hardened to prevent damage to the structure.

# Appendix D-6

## Scrubber Blowdown Waste Water Treatment Unit

## REACTOR SYSTEM

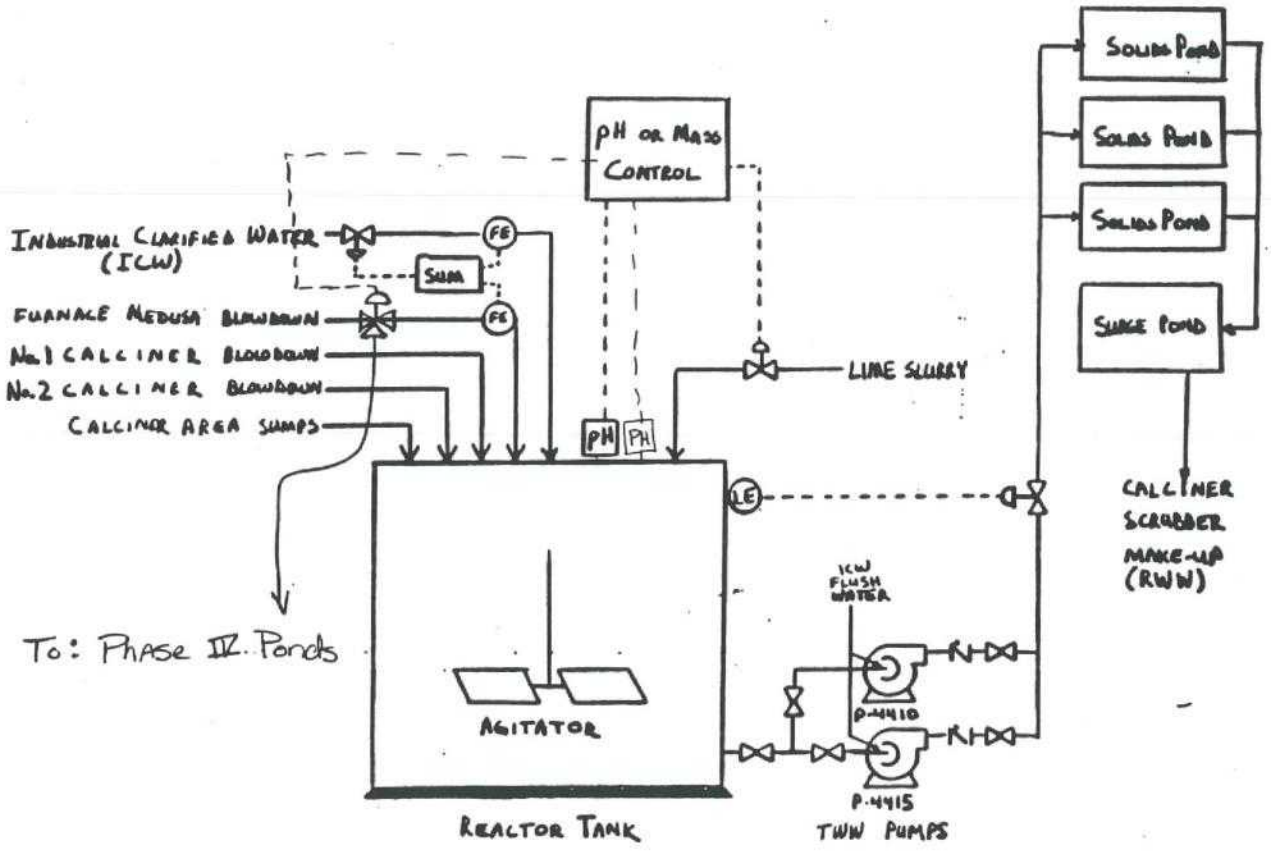
Reactor System Process Description

The purpose of the reactor system is to render Medusa Scrubber Water non-hazardous and make the plant process waters reusable as make-up water to the calciner scrubber. Treatment in the reactor raises the pH and reduces the soluble fluoride and cadmium concentration of the treated water. After solid separation in the ponds the treated waste water (TWW) can then be recycled to the calciner scrubbers to continue fluoride and particulate removal from the calciner water off gases. A schematic of the reactor system is shown in Figure 8.1.

The scrubber blowdowns from No. 1 and No. 2 calciners, the furnace Medusa blowdown (MW), industrial clarified water (ICW), and the calciner pad sumps are all fed into other reactor tank to be treated and recycled. These liquors are treated with slaked lime from the lime slurry tank. The lime is added to the agitated reactor tank to maintain a pH of at least 4.7. Extensive testing during the 1989-90 operation determined that treating the waste liquor to a pH of 4.7 will render the cadmium insoluble. Therefore this waste stream no longer exhibits the characteristic for which it failed.

The pH control in the reactor can be done two ways. Initially direct pH control will be attempted. Two pH probes will continuously monitor the reactor pH. Based on the lowest measured pH, a signal will be sent to the lime slurry control valve to adjust the lime slurry flow to the reactor to maintain the pH setpoint. If the pH setpoint cannot be maintained, then the furnace Medusa water will be diverted to the Phase IV ponds until the problem is corrected. When either probe registers a pH = 4.6 a 3-way on/off valve will automatically divert the Medusa stream to the Phase IV ponds. If the on/off valve does not respond, then the valve may be controlled manually or the furnace Medusa stream may be blocked just before the reactor tank. The other method of pH control is called mass control. When in mass control, the lime addition to the reactor tank is based on the flow rate of the furnace Medusa water, the ICW water and the number of calciners in operation. If mass control is ever used, the pH level in the reactor tank must be checked continuously with an accurate portable pH probe.

The treated waste water (TWW) from the reactor is pumped up to one of the calciner solids ponds. The solids in the TWW are allowed to settle in the solids pond. The clarified water will overflow to the surge pond. From the surge pond the recycled waste water (RWW) gravity flows back to the calciner scrubbers as required for make-up.




Reactor System

FIGURE 8.1

## Reactor System Equipment Description

The major pieces of equipment in the reactor system are the reactor tank, the reactor tank agitator, the treated waste water pumps and the treated waste water control valve.

## Reactor Tank

The reactor tank is a 20 foot diameter by 24 foot tall vessel. The working volume of the tank is approximately 54,000 gallons. The tank bottom and 18 inches of tank wall are constructed of 317LM stainless steel. The rest of the tank is constructed of lined carbon steel. The tank lining is an abrasion resistant, corrosion resistant, reinforced polyester lining. Four anti-swirl baffles are located at 90 degrees spacings on the tank interior wall. The reactor tank overflow nozzle is located 23 feet above the tank bottom. A 30 inch manway is located 4 feet above the tank bottom to allow access into the tank.

## Reactor Tank Agitator

The reactor tank agitator is a Chemineer heavy-duty A-310 turbine type agitator. The agitator is driven by a 7-1/2 HP motor with a gear reducer. The operating speed of the agitator is 37 RPM. The wetted parts of the agitator are constructed of 316 stainless steel. The agitator shaft is 3-1/2 inches in diameter and 241 inches long. The impeller is a 3-bladed axial flow impeller with a diameter of 84 inches.

## Treated Waste Water (TWW) Pumps

Two TWW pumps are provided to continuously pump the treated waste water up to the solids ponds. One TWW pump will operate at all times. The other pump will serve as a spare. The TWW pumps are Durco Model 6x4M-13A "Sealatic Pumps". The pumps are constructed of CD4MCu (ferralium casting) and are rated for 1000 GPM at 100 feet total head. The TWW pumps are designed to have flush water flowing into the expeller section to purge solids from the pump.

## Reactor Tank Level Control Valve

The reactor tank level control valve is a Clarkston Series C 4-inch throttling valve. This valve regulates the flow of TWW to the ponds to control the reactor tank level. The control valve is hypalon lined. The hydraulic valve actuator (Figure 8.2) operates on a 75 psi air supply control by a 3-15 psi pneumatic input signal. The air side of the actuator uses a rolling diaphragm. The larger air piston is coupled to a smaller hydraulic piston. When air is supplied to the actuator the pressure is amplified in the hydraulic cylinder. The hydraulic cylinder is designed to deliver 0-250 psi of pressure to operate

the valve. This valve requires air to close and will therefore fail in the open position upon loss of air supply.

## Reactor System Control Philosophy

### pH Control

The pH of the reactor tank is controlled by regulating the amount of lime slurry added to the reactor. It is very important that the treated waste water being sent to the pond is at the proper pH. Treating to the proper pH does five important things to the waste waters being treated.

1. Reduces the cadmium concentration of the treated waste water below the regulatory level by the EPA.
2. Raises the pH and reduces the soluble fluoride concentration of the recycle waste water so that it may be used as make-up to the calciner scrubbers to absorb more gaseous fluorides.
3. Allows the solids which are settled out in the solids ponds to be classified as a non-hazardous waste.
4. Allows the liquid portion of the treated waste water to be classified as non-hazardous.
5. Reduces the corrosive nature of the recycled waste water to the calciner scrubbers.

The reactor control system is designed to control pH in two different modes. These modes are direct pH control and mass flow control. Figure 8.3 is a schematic which shows how the pH and mass flow control systems interact to control lime addition.

### Direct pH Control

When operating in the pH mode the lime addition to the reactor tank is directly related to the reactor pH. Two pH probes will be used to continuously monitor the reactor pH. This pH signal will be compared to the pH setpoint and then a signal will be sent to adjust the lime slurry control valve. If the pH is below the setpoint, a signal will be sent to increase the lime slurry addition rate. If the reactor pH is above the setpoint, a signal will be sent to reduce the lime flow to the reactor. If the pH level is below the critical level, the furnace Medusa stream will be diverted to the Phase IV ponds.

CLARKSTON

DUAL ROLLING DIAPHRAM ACTUATOR

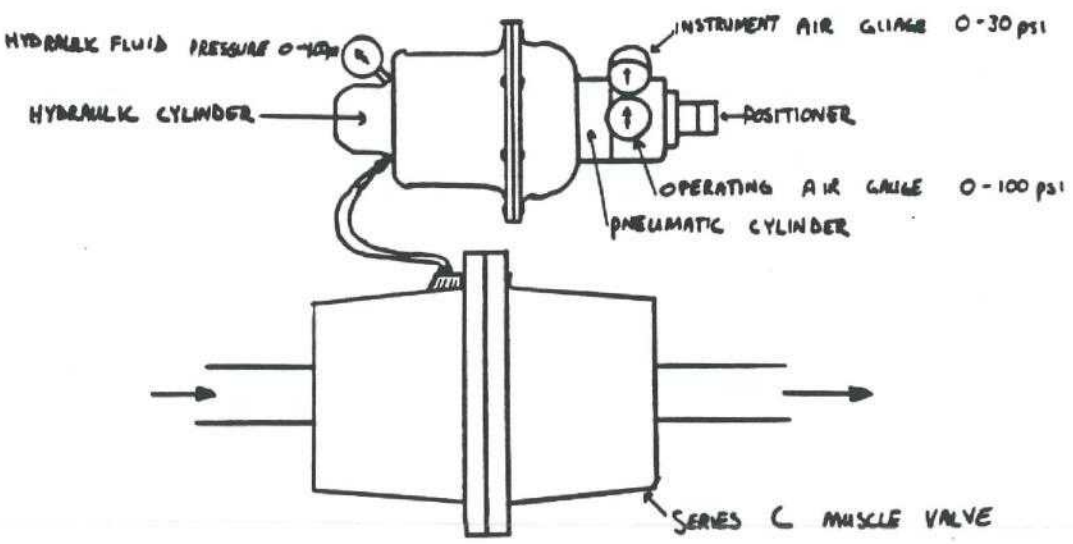



FIGURE 8.2

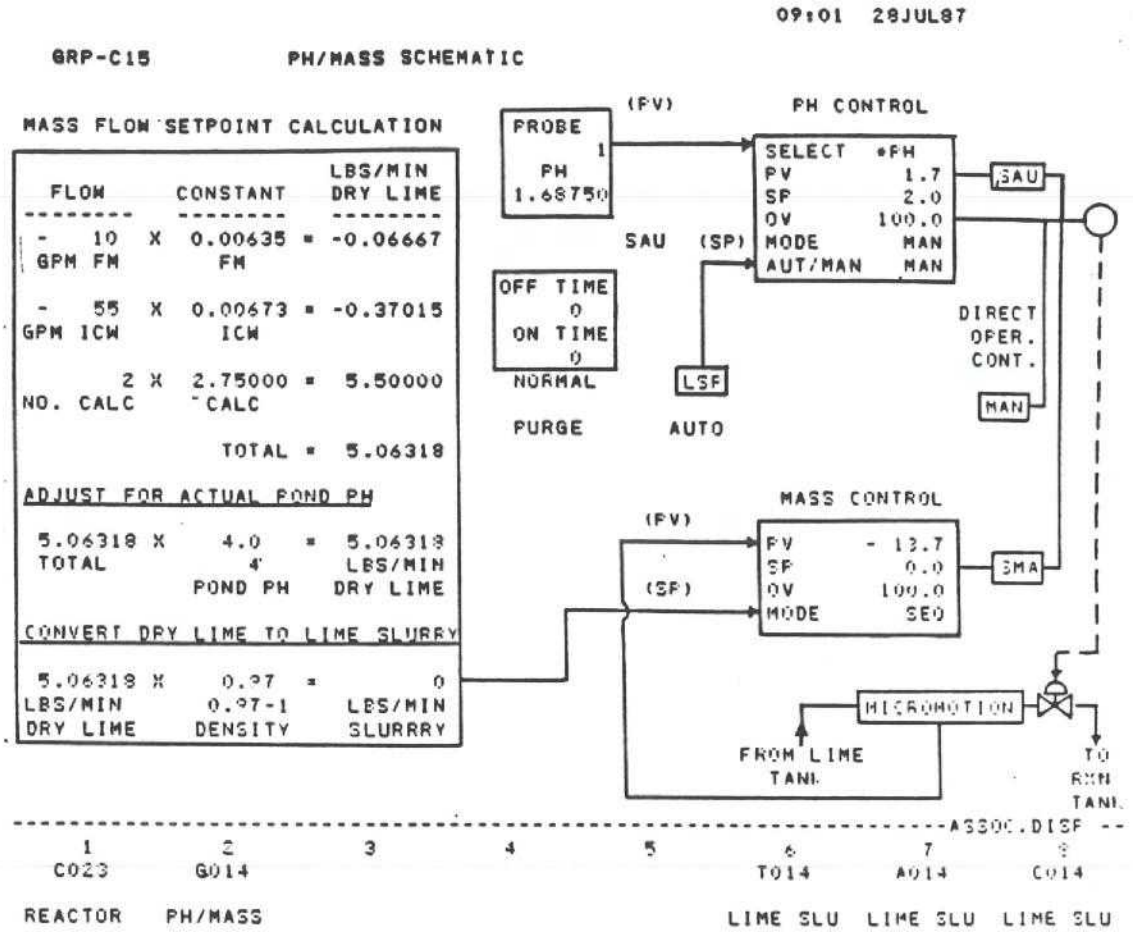

09:01 28JUL87
GRP-C15
PH/MASS SCHEMATIC
MASS FLOW SETPOINT CALCULATION
FLOW
CONSTANT
LBS/MIN DRY LIME
- 10 GPM FM X 0.00635 FM = -0.06667
- 55 GPM ICW X 0.00673 ICW = -0.37015
2 NO. CALC X 2.75000 CALC = 5.50000
TOTAL = 5.06318
ADJUST FOR ACTUAL POND PH
5.06318 TOTAL X 4.0 4' POND PH = 5.06318 LBS/MIN DRY LIME
CONVERT DRY LIME TO LIME SLURRY
5.06318 LBS/MIN DRY LIME X 0.97 0.97-1 DENSITY = 0 LBS/MIN SLURRY
PROBE 1
PH
1.68750
(PV)
PH CONTROL
SELECT *PH
PV 1.7
SP 2.0
OV 100.0
MODE MAN
AUT/MAN MAN
SAU
SAU (SP)
OFF TIME 0
ON TIME 0
NORMAL
PURGE
LSF
AUTO
DIRECT OPER. CONT.
MAN
MASS CONTROL
(PV)
(SP)
PV - 13.7
SP 0.0
OV 100.0
MODE SEQ
BMA
MICROMOTION
FROM LIME TANK
TO RXN TANK
ASSOC.DISP
1 C023 REACTOR
2 G014 PH/MASS
3
4
5
6 T014 LIME SLU
7 A014 LIME SLU
8 C014 LIME SLU

FIGURE 8.3

The pH setpoint will be set at 4.7. At this pH, all of the design criteria of the treatment system are met and the amount of lime required is minimized. At higher pHs more solids will be precipitated in the reactor and more lime will be consumed. This will result in the solids ponds filling up faster and higher lime costs. However, at higher pHs the recycled waste water to the scrubbers becomes less corrosive in nature.

The pH mode of operation will require that both pH probes are always calibrated and in service. The pH probes will be cleaned daily, and calibrated weekly.

Mass Control

When operating in the mass mode the amount of lime slurry added to reactor is based on the flow rate of the furnace Medusa blowdown, the flow rate of ICW, the number of calciners in service, the lime slurry density and the current pH of the calciner surge pond. Figure 8.4 shows how these factors are used to generate a lime slurry flow setpoint. The lime slurry control valve is then adjusted to allow the proper amount of lime to enter the reactor.

Extensive testing during the pilot plant operation allowed for development of the mass flow setpoint algorithm. The furnace Medusa and ICW flows to the reactor are multiplied by factors which are based on their average chemistry. The number of calciners in operation is directly related to the amount of fluorides which will be collected and thus need to be neutralized in the reactor. The current pond pH is then used to adjust the amount of lime required. The density of the lime slurry is then used to convert from amount of dry hydrated lime required to the amount of lime slurry. The advantage of mass control is that it does not depend on successful operation of pH probes. The factors used in this algorithm may need to be updated periodically as plant operating conditions change. However, the pH level of at least 4.6 must be maintained at any given instant, so if this method must be used pH monitoring must be done manually with an accurate portable pH probe. This method should be used only as a final option.

Reactor Tank Level Control

The level in the reactor tank is controlled by adjusting the flow of treated waste water (TWW) pumped up to the ponds to equal the total amount of process contaminated waters entering the reactor. The reactor level is measured by a Milltronics ultrasonic level sensor. The measured level is

## MASS FLOW SETPOINT CALCULATION

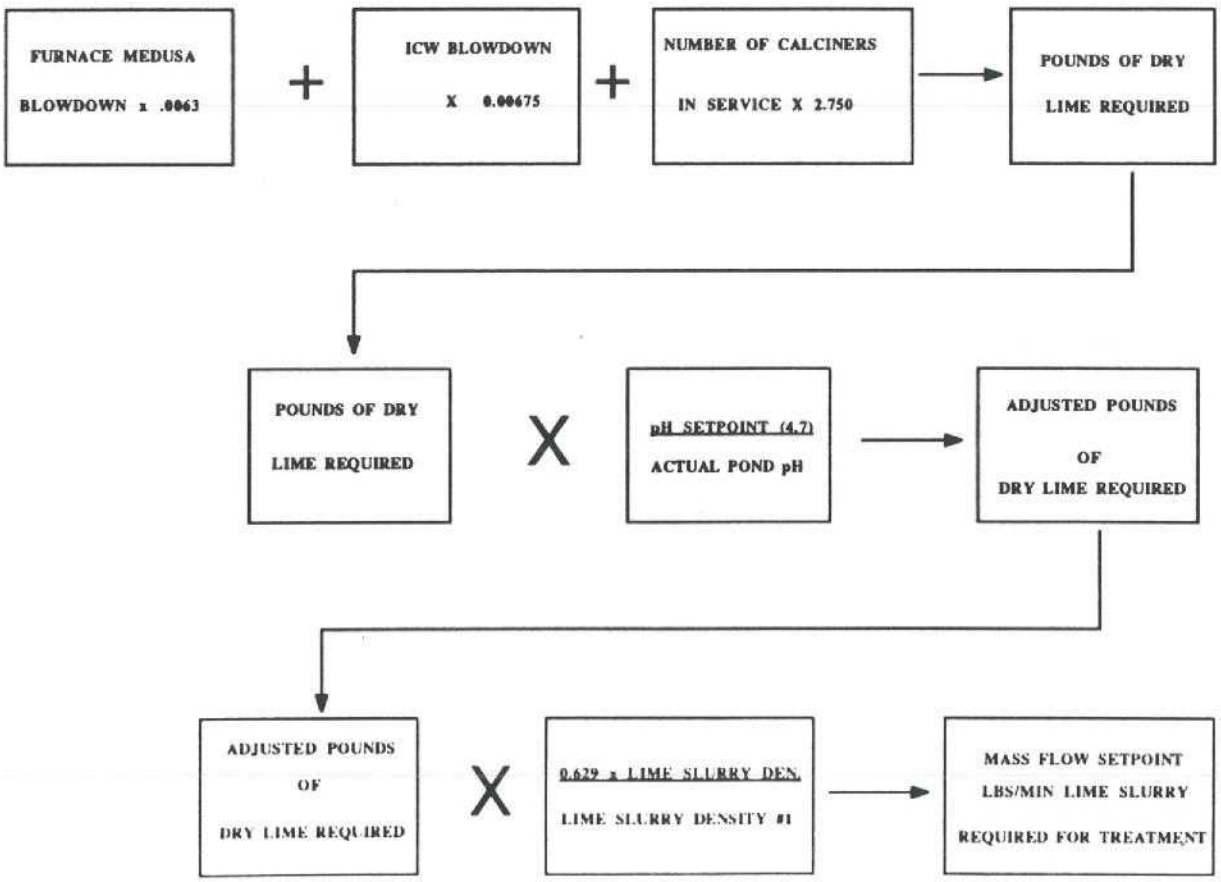



FIGURE 8.4

compared to the level setpoint by the TDC 3000. A signal is then sent to the TWW control valve to adjust the TWW flow to maintain the tank level setpoint.

The reactor tank setpoint will be set at 33% full. This level allows adequate reaction retention time and allows maximum surge capacity above the level setpoint. Figure 8.5 shows the reactor alarm levels in the reactor tank and indicates the importance of each. When the tank level is lowered to 24% the low level alarm is reached. If the tank level continues to drop to 17% the low-low level alarm will be reached and the TWW pumps will automatically be shut down on the low-low level interlock. The high level alarm is reached when the reactor tank level reaches 39% full. This indicates that the level control is out of balance and should be investigated. If the level is allowed to reach 93% full the high-high alarm will be reached and the tank will begin to overflow. If the reactor overflows, it will flow in to the retaining wall area which surrounds the reactor tank. If the liquid is allowed to overflow the retaining wall, then it may cause a CERCLA reportable release under the Resource Conservation and Recovery Act (RCRA). If liquid is ever allowed to overflow the retaining wall, the Environmental Department (ext. 212) will be contacted immediately.

TWW Pump Control

The TWW pump operation is controlled by the TDC 3000 operating station or by the local pushbuttons located at the pump. One pump should be operating at all times with the other pump available as a spare. Feedback alarms are present on both pumps to alert the operator of a pump failure condition. The TWW pumps are interlocked to automatically shutdown if the reactor tank level reaches the low-low level alarm (17% full).

Reactor Tank Agitator Control

The reactor tank agitator is controlled from the TDC 3000 operating station or by the local pushbutton located at the agitator motor. The reactor agitator should be in operation whenever waste water is present in the reactor tank. An agitator motor feedback alarm is present to indicate a motor failure condition.

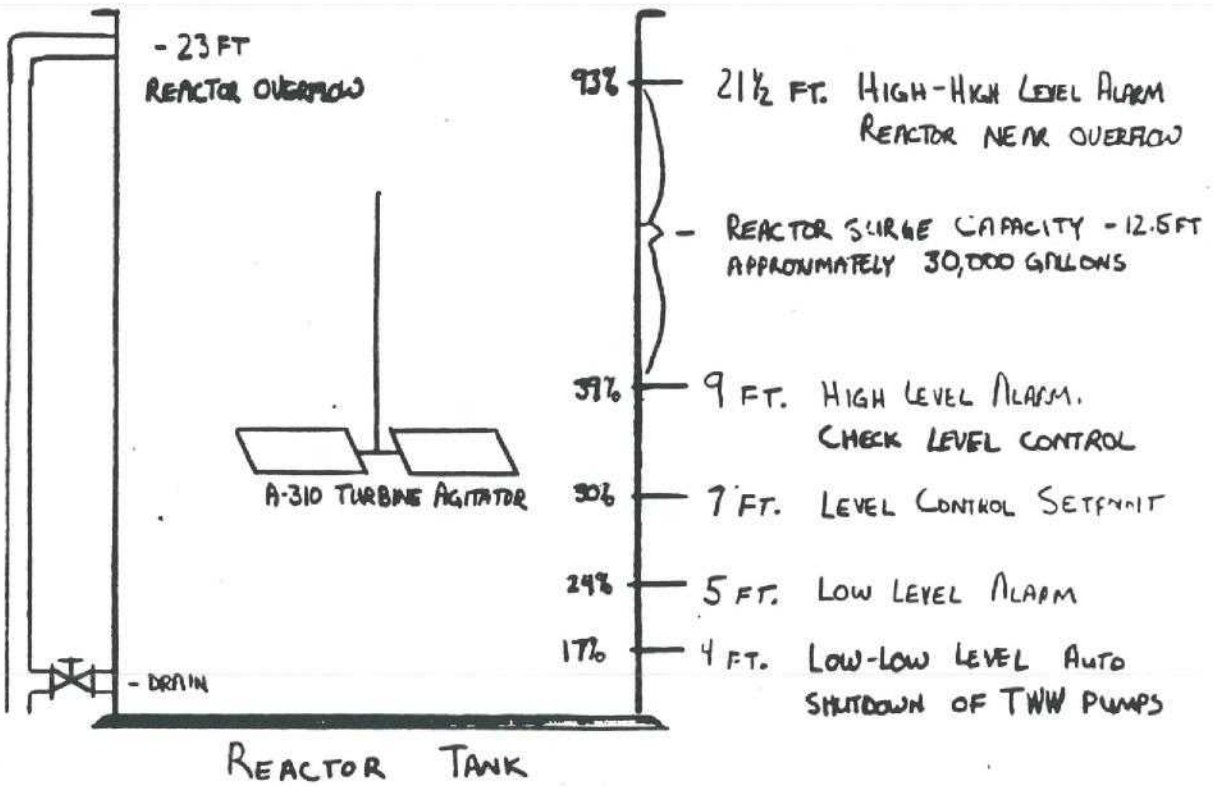

- 23 FT
REACTOR OVERFLOW
93%
21½ FT. HIGH-HIGH LEVEL ALARM
REACTOR NEAR OVERFLOW
REACTOR SURGE CAPACITY - 12.5 FT
APPROXIMATELY 30,000 GALLONS
39%
9 FT. HIGH LEVEL ALARM.
CHECK LEVEL CONTROL
A-310 TURBINE AGITATOR
30%
7 FT. LEVEL CONTROL SETPOINT
24%
5 FT. LOW LEVEL ALARM
17%
4 FT. LOW-LOW LEVEL AUTO
SHUTDOWN OF TWW PUMPS
- DRAIN
REACTOR TANK

FIGURE 8.5

Facility Name: FMC

EPA ID #: ID 9518

# *CBI Material on this Facility in WMB Safe*